Sampling and Analysis Plan for Non-Time Critical Removal Support Gulfco Marine Maintenance Site Freeport, Brazoria County, Texas EPA Identification No. TXD055144539

Remedial Action Contract 2 Full Service Contract: EP-W-06-004 Task Order: 0067-NSEE-06JZ

Prepared for

U.S. Environmental Protection Agency
Region 6
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29 November 2010

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U.S. Environmental Protection Agency Region 6 Task Order Monitor

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LIST OF ACRONYMS AND ABBREVIATIONS

AST	Aboveground Storage Tank
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limits
DQO	Data Quality Objective
EE/CA	Engineering Evaluation and Cost Analysis
EA	EA Engineering, Science, and Technology, Inc.
EDD	Electronic Data Deliverable
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
ft	Feet
Gulfco	Gulfco Marine Maintenance
HSP	Health and Safety Plan
LCS	Laboratory Control Sample
MACTEC	MACTEC Engineering and Consulting, Inc.
MDL	Method Detection Limit
MD	Matrix Duplicate
MQO	Measurement Quality Objective
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NTCRS	Non-time Critical Removal Support
OSHA	Occupational Safety and Health Administration
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, Sensitivity
PRP	Potentially Responsible Party
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAC 2	Remedial Action Contract 2
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
SVOC	Semivolatile Organic Compound
TCEQ	Texas Commission on Environmental Quality
TOM	Task Order Monitor
VOC	Volatile Organic Compound

1. PROJECT DESCRIPTION AND MANAGEMENT

EA Engineering, Science, and Technology, Inc. (EA) has been authorized by the U.S. Environmental Protection Agency (EPA), under Remedial Action Contract (RAC) No. EP-W-06-004, Task Order 0062-RICO-067Z, to provide non-time critical removal support (NTCRS) services at the Gulfco Marine Maintenance (Gulfco) Superfund site, located at 906 Marlin Avenue, Freeport, Brazoria County, Texas. EA has prepared this Sampling and Analysis Plan (SAP) in accordance with: (1) specifications provided in the EPA Task Order Statement of Work (SOW), dated 6 October 2010 (EPA 2010c); (2) the EPA-approved EA Work Plan (EA 2010b); and (3) subsequent discussions with EPA.

This SAP is a combination Quality Assurance Project Plan and Field Sampling Plan that has been prepared to detail sample collection procedures and analytical methods needed to collect sufficient data for the NTCRS activities at the Gulfco site. Combining these two standard deliverables into a single document allows a streamlining of the planning process, while ensuring that data collected are of sufficient quality for its intended use.

This SAP was prepared in conjunction with the Health and Safety Plan (HSP) (EA 2010c), which together, present the overall approach for implementing the RI field program. The HSP specifies employee training, protective equipment, personal air monitoring procedures, medical surveillance requirements, standard operating procedures, and contingency planning procedures. This SAP was prepared in accordance with EA's Quality Management Plan (EA 2010a) and meets requirements set forth in *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5* (EPA 2001) and *EPA Guidance for Quality Assurance Project Plans, QA/G-5* (EPA 2002). This SAP describes procedures to assure that the project-specific data quality objectives (DQOs) are met, and that the quality of data (represented by precision, accuracy, completeness, comparability, representativeness, and sensitivity) is known and documented. The SAP presents the project description, project organization and responsibilities, and quality assurance (QA) objectives associated with the sampling and analytical services to be provided in support of NTCRS activities at the Gulfco site. Table 1 demonstrates how this SAP complies with all elements of a QAPP currently required by EPA guidance (EPA 2001, 2002).

The overall QA objectives are as follows:

- Attain quality control (QC) requirements for analyses specified in this SAP
- Obtain data of known quality for the NTCRS and ecological risks
- Document performance of the PRP's quality program including performance of the work and any required changes to work at the site.

The EA Project Manager, Mr. Al Sloan, is responsible for implementing all activities required by this Task Order. Figure 1 presents the proposed project organization for this Task Order. The EPA Region 6 Task Order Monitor (TOM), Mr. Gary Miller, is responsible for the NTCRS activities. EA and its team subcontractor, MACTEC Engineering and Consulting, Inc. (MACTEC), will perform all tasks under this Task Order in accordance with this SAP.

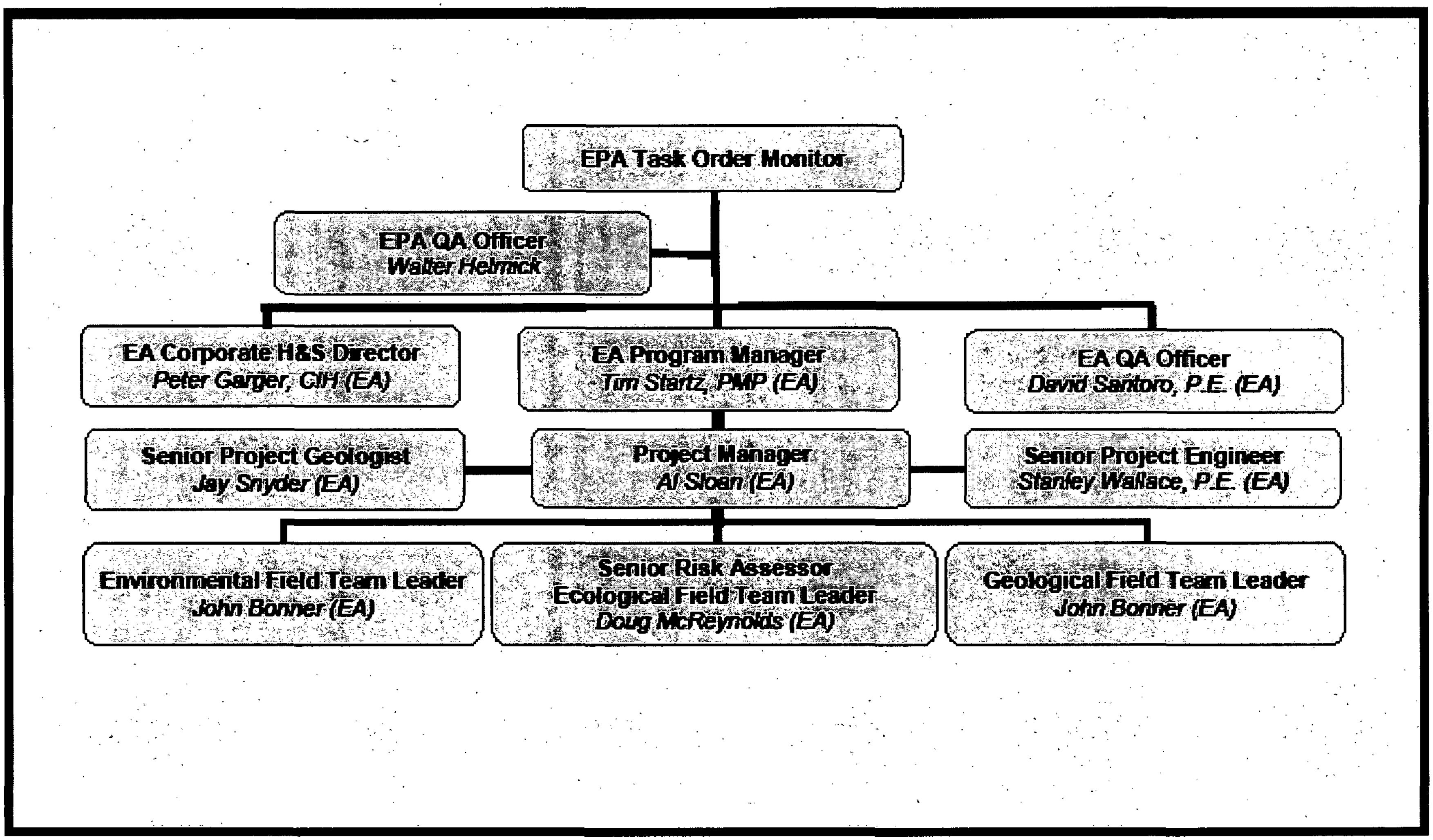

Figure 1. Project Organization.

TABLE 1 ELEMENTS OF U.S. ENVIRONMENTAL PROTECTION AGENCY QA/R-5 IN RELATION TO THIS SAMPLING AND ANALYSIS PLAN

EPA QA/R-5 Quality Assurance Project Plan Element		EA SAP	
A1	Title and Approval Sheet	Title and Approval Sheet	
A2	Table of Contents	Table of Contents	
A3	Distribution List	Distribution List	
A4	Project/Task Organization	1.0	Project Description and Management
A5	Problem Definition/Background	1.1	Site Background and Problem Definition
A6	Project/Task Description	1.2	Description of Project Objectives and Tasks
A7	Quality Objectives and Criteria	1.3	Data Quality and Measurement Objectives
A8	Special Training/Certification	1.4	Special Training Requirements and Certification
A9	Documents and Records	1.5	Documentation and Records
B1	Sampling Process Design	2.1	Sampling Process Design
B2	Sampling Methods	2.2	Sampling Methods
B3	Sample Handling and Custody	2.3	Sample Handling and Custody Requirements
B4	Analytical Methods	2.4	Analytical Methods Requirements
B5	Quality Control	2.5	Quality Control Requirements
B6	Instrument/Equipment Testing, Inspection, and Maintenance	2.6	Instrument and Equipment Testing, Inspection, and Maintenance Requirements
B7	Instrument/Equipment Calibration and Frequency	2.7	Instrument Calibration and Frequency
B8	Inspection/Acceptance of Supplies and Consumables	2.8	Requirements for Inspection and Acceptance of Supplies and Consumables
B9	Non-Direct Measurements	2.9	Data Acquisition Requirements (Non-Direct Measurements)
B10	Data Management	2.10	Data Management
C1	Assessment and Response Actions	3.1	Assessment and Response Actions
C2	Reports to Management	3.2	Reports to Management
D1	Data Review, Verification, and Validation	4.1	Data Review and Reduction Requirements
D2	Validation and Verification Methods	4.2	Validation and Verification Methods
D3	Reconciliation with User Requirements	4.3	Reconciliation with Data Quality Objectives

1.1 SITE BACKGROUND AND PROBLEM DEFINITION

This section describes the following:

- Site background and description (Section 1.1.1)
- Problem definition (Section 1.1.2).

1.1.1 Site Background

The Gulfco site is located in Freeport, Texas, at 906 Marlin Avenue (also referred to as County Road 756). The site consists of approximately 40 acres within the 100-year coastal floodplain along the north bank of the Intracoastal Waterway between Oyster Creek approximately 1 mile to the east and the Texas Highway 332 bridge approximately 1 mile to the west. The site includes approximately 1,200 feet (ft) of shoreline on the Intracoastal Waterway, a coastal shipping canal that extends from Port Isabel to West Orange on the Texas Gulf Coast.

Marlin Avenue divides the Gulfco site into two areas. The property to the north of Marlin Avenue consists of wetlands and the closed surface impoundments. The property south of Marlin Avenue was developed for industrial uses with a dry dock, sand blasting areas, an aboveground storage tank (AST) tank farm, and two barge slips connected to the Intracoastal Waterway. The site was operated as a barge cleaning and repair facility from 1971 until 1999.

The former surface impoundments were three contiguous earthen pits with natural clay liners located in Lot 56 on the north side of Marlin Avenue. These former impoundments were used for storage of waste oils, caustics, various organic chemicals, and wash waters generated during barge cleaning activities. The former impoundments were closed in 1982 when the liquids and majority of sludges were removed and the remaining sludge was solidified with soil and left in place. The former impoundments were then capped with 3-feet of clay cover and a hard wearing (shell) surface. During recent investigations at the site, the cap was found to be between 2.5-ft and 3.6-ft thick, and was rutted on the western end.

Previous investigations at the Gulfco site found that the sediment north of Marlin Avenue contained several chemicals of potential ecological concern at concentrations exceeding the screening levels (see Appendix A). These chemicals include polynuclear aromatic hydrocarbons and several metals. Subsequent investigations by the PRP have shown that the sediments are not toxic to the polycheate worm <u>Neanthes arenaceodentata</u> and the amphipod <u>Leptocheirus plumulosus (PBW 2010)</u>.

1.1.2 Problem Definition

The purpose of this Task Order is to implement the NTCRS at the Gulfco site to select a removal action alternative to eliminate, reduce, or control risks to human health and the environment. The NTCRS will consist of preparation of an Engineering Evaluation and Cost Analysis (EE/CA) report and a Preliminary Draft Action Memorandum for the repair of an existing cap over the former impoundments and for a wetlands sediment hot-spot removal. However, EPA will determine the selected removal alternative. Toxicity sampling recently performed at the Gulfco site by the potentially responsible parties (PRPs) is being used to determine whether the wetland sediment hot-spot removal will be required. For planning purposes, the sediment removal has been included in the scope of the EE/CA, and will remain a part of the Task Order until or unless the PRP data and EA sampling results indicate that the sediment hot-spot removal is not required to protect human health and the environment. The data to be collected as part of this Task Order work scope are expected to be available sometime in the March 2011 timeframe.

The EPA SOW (2010c) and approved Work Plan (EA 2010b) sets forth the framework and requirements for the NTCRS activities. The goal for completion of this Task Order is 31 May 2011.

1.2 DESCRIPTION OF PROJECT OBJECTIVES AND TASKS

This section describes the project objectives and tasks for this SAP.

1.2.1 Project Objectives

The primary objectives for this SAP are as follows:

- Collect sufficient sediment data to (1) visually delineate the nature and extent of the contamination and evaluate the underlying soil conditions; and (2) resolve any data gaps identified for the wetland areas located north of Marlin Avenue following evaluation of the recent data collected by the PRP.
- Collect sufficient data to evaluate lithology and hydraulic conductivity of existing cap material.
- Determine suitability of soil from the borrow area onsite for use in repairing the existing cap.

Based on technical direction provided by EPA during the scoping meeting, EA will submit samples for chemical analysis to the Contract Laboratory Program (CLP) l. EA anticipates CLP laboratory analysis of the following sample quantities (subject to change):

- Eight (8) wetland sediment samples will be analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, and pesticides.
- Three (3) soil cores through the existing cap material for vertical hydraulic conductivity testing.
- Two (2) borrow area clay samples will be analyzed for VOCs, SVOCs, metals, pesticides, and physical geotechnical parameters.

The analytical parameters, number of samples, and sample media are discussed in greater detail in Section 2.

1.2.2 Tasks

To complete the NTCRS activities, EA will perform the following tasks (with subtasks), which are outlined in the approved Work Plan (EA 2010b):

- Project Planning and Support
- Community Involvement
- Field Investigation/Data Acquisition
- Sample Analysis
- Analytical Support and Data Validation
- Data Evaluation
- Risk Assessment
- Identification and Screening of Removal Alternatives

- Analysis of Removal Alternatives
- Engineering Evaluation/Cost Analysis Report
- Post-EE/CA Support
- Task Order Closeout.

To meet the project objective, EA's tasks include the collection of samples. EA's field activities will be conducted in accordance with this SAP to ensure the proper management of samples, including accurate chain-of-custody procedures for sample tracking, protective sample-packing techniques, and proper sample-preservation techniques. The requirements of EA's site-specific HSP (EA 2010c) will be followed. Sample management will be conducted using the EPA-approved Forms II Lite software. EA will document the characterization and disposal of investigation-derived wastes in accordance with local, state, and federal regulations, as appropriate.

1.3 DATA AND MEASUREMENT QUALITY OBJECTIVES

The following subsections present the DQOs and measurement quality objectives (MQOs) identified for this project.

1.3.1 Data Quality Objectives

DQOs are qualitative and quantitative statements developed through the seven-step DQO process (EPA 2000; 2006a). The DQOs clarify the study objective, define the most appropriate data to collect and the conditions under which to collect the data, and specify acceptance criteria that will be used to evaluate whether the quantity and quality of data collected are sufficient to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection. The seven steps of the DQO process for this project are as follows:

- Step 1 – State the Problem
  - Define the problem that necessitates the study.
  - Identify the planning team.
  - Examine budget and schedule.

- Step 2 – Identify the Goal of the Study
  - State how environmental data will be used in meeting objectives and solving the problem.
  - Identify study questions.
  - Define alternative outcomes.

- Step 3 – Identify Information Inputs
  - Identify data and information needed to answer study questions.

- Step 4 – Define the Boundaries of the Study
  - Specify the target population and characteristics of interest.
  - Define spatial and temporal limits.

— Define the scale of inference.

- Step 5 – Develop the Analytical Approach
  — Define the parameter of interest.
  — Specify the type of inference.
  — Develop the logic for drawing conclusions from findings.

- Step 6 – Specify the Performance or Acceptance Criteria
  — Specify probability limits for false rejection and false acceptance decision errors.
  — Develop performance criteria for new data being collected or acceptance criteria for existing data being considered for use.

- Step 7 – Develop the Plan for Obtaining Data
  — Select the resource-effective sampling and analysis plan that meets the performance criteria.

The 7-step iterative process used to prepare the DQOs for this project is presented in Table 2.

TABLE 2 DATA QUALITY OBJECTIVES

STEP 1: STATE THE PROBLEM
• Wetland areas north of Marlin Avenue have not been adequately delineated by the PRP. Additional sediment data is required to (1) visually delineate the nature and extent of the contamination and evaluate the underlying soil conditions; and (2) resolve any data gaps identified for the wetland areas located north of Marlin Avenue following evaluation of the recent data collected by the PRP. • The existing cap that covers the former surface impoundments requires repair. Additional data is required to evaluate the vertical hydraulic conductivity of existing cap material. • Additional information is required to determine the suitability of soil from the onsite borrow area for use in repairing the existing cap.
STEP 2: IDENTIFY THE GOALS FOR THE STUDY
• Collect sediment samples from designated wetland areas to (1) visually delineate the nature and extent of the contamination and evaluate the underlying soil conditions; and (2) resolve any data gaps identified for the wetland areas located north of Marlin Avenue following evaluation of the recent data collected by the PRP. • Collect soil core samples to evaluate the vertical hydraulic conductivity of existing cap material. • Determine the suitability of the borrow materials from onsite borrow area for use in repairing the existing cap.
STEP 3: IDENTIFY INPUTS TO THE DECISIONS
• Analytical results for wetland sediment samples • Geotechnical testing data for existing cap material • Analytical and geotechnical data for onsite borrow material.

STEP 4: DEFINE STUDY BOUNDARIES

- For wetland sediments, the horizontal study boundary is defined by the Former Surface Impoundment Area (Figure 2), and the vertical boundary is 6 inches deep.
- For samples collected from the existing cap, the horizontal study boundary is the existing cap over the former surface impoundments, and the vertical boundary is no deeper than 5 feet into the existing cap.
- For borrow area samples, the horizontal study boundary is the borrow area, and the vertical boundary approximately one foot.

STEP 5: DEVELOP THE ANALYTIC APPROACH

- Sediment samples will be analyzed for VOCs, SVOCs, organochlorine pesticides, and metals using CLP SOM01.2 (EPA 2005; 2007a) and ISM01.2 (EPA 2010a); analytical results will be compared to TCEQ ecological screening sediment benchmarks (TCEQ 2001; 2006) and PRP data.
- Soil cores from the existing cap material will undergo vertical hydraulic conductivity testing to determine the permeability of the existing cap to moisture.
- Borrow material samples will be analyzed for VOCs, SVOCs, organochlorine pesticides, and metals using CLP SOM01.2 (EPA 2005; 2007a) and ISM01.2 (EPA 2010a); analytical results will be compared to TCEQ ecological screening sediment benchmarks (TCEQ 2001; 2006) and PRP data. Samples will be also undergo geotechnical testing.

STEP 6: SPECIFY THE PERFORMANCE OR ACCEPTANCE CRITERIA

- Sediment samples will be analyzed by CLP and EPA methods that have been selected based on the reporting limits capable of evaluating concentrations below TCEQ ecological screening sediment benchmarks (TCEQ 2001; 2006).
- QA samples will be collected during each phase of sampling to evaluate sampling techniques and consistency.
- Analytical results will be evaluated within their own tolerance limits and compared to TCEQ ecological screening sediment benchmarks (TCEQ 2001; 2006) and PRP data.

STEP 7: DEVELOP THE PLAN FOR OBTAINING DATA

- Sediment sample data will be compared to TCEQ ecological screening sediment benchmarks (TCEQ 2006) and PRP data to (1) visually delineate the nature and extent of the contamination and evaluate the underlying soil conditions; (2) resolve any data gaps; and (3) evaluate the usability of collocated PRP data.
- Vertical hydraulic conductivity data will be used to determine the permeability of the existing cap to moisture.
- Borrow material data will be used to establish the suitability of the material for use in repairing the existing cap.

Key to systematic planning is determining whether the problem to be solved requires a quantitative or qualitative answer (EPA 2000a,b,c; 2006a). Only data from fixed laboratories will be collected and analyzed during the investigation. The fixed-laboratory analyses for the sediment samples collected from wetlands areas and soil/sediment samples collected from the borrow area will be conducted by a EPA-designated Contract Laboratory Program (CLP) laboratory. However, if the CLP does not have capacity or cannot perform a specific analysis to a level of precision determined through the measurement quality objective (MQO) evaluation, a subcontracted non-CLP laboratory may be used. Testing of geotechnical soil samples will be performed by a non-CLP fixed laboratory.

1.3.2 Measurement Quality Objectives

Analytical results will be evaluated in accordance with precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) parameters to document the quality of the data and to ensure that the data are of sufficient quality to meet the project objectives. Of these PARCCS parameters, precision and accuracy will be evaluated quantitatively by utilizing both the field and laboratory QC samples listed in Table 3. Field QC samples utilized are field duplicate samples, trip blanks, and field blanks (to be collected only if field conditions render them necessary). In addition, additional sample volume may need to be collected in the field to ensure that the laboratory has sufficient material to prepare the matrix spike (MS) and matrix spike duplicates (MSD), as appropriate; the laboratory will be contacted prior to mobilization to clarify which analyses require this additional volume. Laboratory QC samples are composed of laboratory control samples, method blanks, calibration blanks, MS/MSDs, and matrix duplicates (MDs). The subsections below describe each of the PARCCS parameters and how they will be assessed within this project.

TABLE 3 QUALITY ASSURANCE INDICATOR CRITERIA

Indicator Parameter	Analytical Parameter	QC Sample	Acceptance Criteria for Laboratory Analysis
Accuracy (percent recovery)	VOCs, SVOCs, pesticides	MS, MSD Blanks	50 to 150 percent recovery Less than CRQL
	Metals	MS LCS Blanks	75 to 125 percent recovery 80 to 120 percent recovery Less than CRDL
Precision (RPD)	VOCs, SVOCs, pesticides	MS, MSD Field duplicates	30 percent RPD 50 percent RPD
	Metals	MS, MD Field duplicates	35 percent RPD (solid) 50 percent RPD
Sensitivity (quantitation limits)	All analytical tests	MS, MD, MSD Field duplicates	Not applicable
Completeness	The objective for data completeness is 90 percent.		
Representativeness	The sampling network analytical methods for this site are designed to provide data that are representative of site conditions.		
Comparability	The use of standard published sampling and analytical methods, and the use of QC samples, will ensure data of known quality. These data can be compared to any other data of known quality.		

NOTE: CRDL = Contract-required detection limit
CRQL = Contract-required quantitation limit
LCS = Laboratory control sample
LCSD = Laboratory control sample duplicate
MD = Matrix duplicate
MS = Matrix spike
MSD = Matrix spike duplicate
RPD = Relative percent difference.

1.3.2.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Usually, combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD).

RPD is calculated as follows:

$$RPD = \frac{|A - B|}{(A + B)/2} \times 100\%$$

where

A = First duplicate concentration.
B = Second duplicate concentration.

Field sampling precision is evaluated by analyzing field duplicate samples. For every 10 samples collected, 1 blind duplicate sample will be collected.

Laboratory analytical precision is evaluated by analyzing laboratory duplicates or MSs and MSDs. For this project, MS/MSD samples will be generated for all organic analytes and MS only for the inorganic (specifically metals) analyses. The results of the analysis of each MS/MSD pair will be used to calculate the RPD as a measure of laboratory precision for organic compounds, while the MS and MD will be used for this purpose in the case of inorganic compounds.

1.3.2.2 Accuracy

A program of sample spiking will be conducted to evaluate laboratory accuracy. This program includes analysis of the MS and MSD samples, laboratory control samples (LCSs) or blank spikes, surrogate standards, and method blanks. MS and MSD samples will be prepared and analyzed at a frequency of 5 percent. LCS or blank spikes are also analyzed at a frequency of 5 percent. Surrogate standards, where available, are added to every sample analyzed for organic constituents. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

$$\text{Percent Recovery} = \frac{S - C}{T} \times 100\%$$

where

S = Measured spike sample concentration
C = Sample concentration
T = True or actual concentration of the spike.

1.3.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination.

Representativeness of data will also be ensured through the consistent application of established field and laboratory procedures. Trip and field blanks (if appropriate) and laboratory blank samples will be evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results. Data usability will be determined by comparison with existing data. If deemed usable but non-representative, it will be used only accompanied by appropriate qualifiers and limits of uncertainty.

1.3.3 Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when all of the QC criteria that affect data usability are met.

When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

Completeness will also be evaluated as part of the data quality assessment process (EPA 2006b; 2006c). This evaluation will help determine whether any limitations are associated with the decisions to be made based on the data collected.

1.3.4 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

1.3.5 Detection and Quantitation Limits (Sensitivity)

The analytical parameters and their quantitation limits for use on this project are determined under the EPA CLP SOWs (EPA 2005; 2007a; 2010a). The Contract-required Detection Limit (CRDL) is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The quantitation limit represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a sample matrix. Contract-required Quantitation Limits (CRQLs) are contractually specified maximum quantitation limits for specific analytical methods and sample matrices, such as soil or water, and are typically several times the method detection limit (MDL) to allow for matrix effects.

For this project, CLP analytical methods have been selected for sediment samples in an attempt to have CRQLs for each target analyte below the action levels, if possible. Table 4 compares the CRQLs for Gulfco wetland area sediment chemicals of potential ecological concern to their associated screening levels (i.e., Texas Commission on Environmental Quality [TCEQ] ecological screening sediment benchmarks [2001, 2006]). For this project, samples results will be reported as estimated values if concentrations are less than CRQLs but greater than CRDLs. The CRDL for each analyte will be listed as the detection limit in the laboratory's electronic data deliverable (EDD).

TABLE 4 CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN SEDIMENT BENCHMARKS

Chemical	CRQL ug/kg (EPA 2007a,b)			TCEQ Marine Sediment Benchmark ug/kg (TCEQ 2006)
	Low soil by SIM	Soil	Low Soil	
2-Methylnaphthelene	3.3		170	70
4,4,DDT		3.3		1.19
Acenaphthene	3.3		170	16
Acenaphthylene	3.3		170	44
Antracene	3.3		170	85.3
Arsenic		1,000		8.2
Benzo (a) anthracene	3.3		170	261
Benzo (a) pyrene	3.3		170	430
Benzo (g, h, i) perylene	3.3		170	----
Chrysene	3.3		170	384
Copper		2,500		34,000
Dibenzo (a,h) anthracene	3.3		170	63.4
Endrin Aldehyde		3.3		----
Endrin Ketone		3.3		----
Fluoranthene	3.3		170	600
Fluorene	3.3		170	19
Gamma-chlordane		1.7		2.26
Indeno (1, 2, 3-cd) pyrene	3.3		170	----
Lead		1,000		46,700
Nickel		4,000		20,900
Phenanthrene	3.3		170	240
Pyrene	3.3		170	665
Zinc		6,000		150,000

1.4 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATION

This section outlines the training and certification required to complete the activities described in this SAP. The following sections describe the requirements for the EA team and subcontractor personnel working onsite.

1.4.1 Safety and Health Training

EA team personnel who work at hazardous waste project sites are required to meet the Occupational Safety and Health Administration (OSHA) training requirements defined in 29 Code of Federal Regulations (CFR) 1910.120(e). These requirements include: (1) 40 hours of formal offsite instruction; (2) a minimum of 3 days of actual onsite field experience under the supervision of a trained and experienced field supervisor; and (3) 8 hours of annual refresher training. Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least 8 additional hours of specialized supervisor training. At least one member of the field team will maintain current certification in first aid and cardiopulmonary resuscitation.

Copies of the field team's safety and health training records, including course completion certifications for the initial and refresher safety and health training, specialized supervisor training, and first aid and cardiopulmonary resuscitation training, are maintained in project files. Before work begins at a specific hazardous waste project site, EA personnel are required to undergo site-specific training that thoroughly covers the following areas:

- Names of personnel and alternates responsible for safety and health at a hazardous waste project site
- Safety and health hazards present onsite
- Selection of the appropriate personal protective equipment
- Correct use of personal protective equipment
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment onsite
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances.

For more safety and health details, see EA's site-specific HSP (EA 2010c).

1.4.2 Subcontractor Training

Subcontractors who work on site will certify that their employees have been trained for work on hazardous waste project sites, except in select instances where the subcontractor is performing work of a limited and non-intrusive nature, such as mowing vegetation. Training will meet OSHA requirements defined in 29 CFR 1910.120(e). Before work begins at the project site, subcontractors will submit copies of the training certification for each employee to EA.

All employees of associate and professional services firms and technical services subcontractors will attend a safety briefing and complete the Safety Meeting Sign-Off Sheet before they conduct onsite work. This briefing is conducted by the EA health and safety officer or other qualified person.

Subcontractors are responsible for conducting their own safety briefings. EA personnel may audit these briefings.

1.5 DOCUMENTATION AND RECORDS

The following sections discuss the requirements for documenting field activities and for preparing laboratory data packages. This section also describes reports that will be generated as a result of this project.

1.5.1 Field Documentation

Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities and will follow Standard Operating Procedure (SOP) No. 16 (Appendix C). The logbook will list the Task Order name and number; site name; and names of subcontractors, service client, and Project Manager. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all onsite personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Notes of conversations with coordinating officials
- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SAP or other governing documents
- Description of all photographs taken.

1.5.2 Laboratory Documentation

This section describes the data reporting requirements for (1) EA field personnel, (2) CLP laboratories (e.g., EPA CLP laboratories or EPA Region 6 Laboratory), and (3) subcontracted (non-CLP laboratories) that submit field and laboratory measurement data under the EPA Region 6 RAC program.

EA will require fixed offsite non-CLP laboratories to prepare and submit data packages in accordance with the EPA CLP protocols (EPA 2005; 2007a; 2008; 2010a; 2010b) for hardcopy and electronic data deliverable format of VOC, SVOC, pesticide, and metal data. Data packages will include all applicable documentation for independent validation of data and verification of the DQOs. The following documentation will be required for full data validation, if applicable:

- Case narratives, which will describe all QC non-conformances that are encountered during the analysis of samples in addition to any corrective actions that are taken

    — Statement of samples received
    — Description of any deviations from the specified analytical method
    — Explanations of data qualifiers that are applied to the data
    — Any other significant problems that were encountered during analysis

- Tables that cross-reference field and laboratory sample numbers
- Chain-of-custody forms, which pertain to each sample delivery group or sample batch that is analyzed
- Laboratory reports, which must show traceability to the sample analyzed and must contain specified information

    — Project identification
    — Field sample number
    — Laboratory sample number
    — Sample matrix description

- Dates and times of sample collection, receipt at the laboratory, preparation, and analysis
- Description of analytical method and reference citation
- Results of individual parameters, with concentration units, including second column results, second detector results, and other confirmatory results, where appropriate
- Quantitation limits achieved
- Dilution or concentration factors.

- Data summary forms and QC summary forms showing analytical results, if applicable
  - Samples
  - Surrogates
  - Blanks
  - Field QC samples
  - LCS
  - Initial and continuing calibrations
  - Other QC samples

- Laboratory control charts
  - Raw data
  - Instrument printouts
  - Laboratory bench sheets for preparation of samples

- MDL study results.

EA's Project Manager, in cooperation with the QA Officer, will define site-specific requirements for data reporting. Requests for analytical services (discussed in Section 2.4) clearly define these requirements, the turnaround time for receipt of the data deliverables specified, and any requirements for retaining samples and laboratory records. Laboratory QA Managers are responsible for ensuring that all laboratory data reporting requirements in the SAP are met.

1.5.3 Full Data Package

When a full data package is required, the laboratory will prepare data packages in accordance with the instructions provided in the EPA CLP SOW (EPA 2005; 2007a; 2008; 2010a; 2010b). Full data packages will contain all of the information from the summary data package and all associated raw data. In the case where a non-CLP subcontract laboratory is used, full data packages are due to EA within 35 days after the last sample in the sample delivery group is received. Unless otherwise requested, the subcontractor will deliver one copy of the full data package.

1.5.4 Reports Generated

During the NTCRS field program, EA will prepare weekly field activity reports. Following the completion of the NTCRS field program and receipt of validated data, EA will prepare the following reports associated with the Gulfco site NTCRS Task Order:

- Data Validation Report
- Data Evaluation Summary Report
- EE/CA Report
- Action Memorandum.

2. DATA GENERATION AND ACQUISITION

This section describes the design and details for the planned field investigation activities. Data evaluation procedures are discussed in Section 4.3.

2.1 SAMPLING PROCESS DESIGN

As stated previously, the primary objectives for this SAP are as follows:

- Collect sufficient sediment data to (1) visually delineate the nature and extent of the contamination and evaluate the underlying soil conditions; and (2) resolve any data gaps identified for the wetland areas located north of Marlin Avenue following evaluation of the recent data collected by the PRP.
- Collect sufficient data to evaluate lithology and hydraulic conductivity of existing cap material.
- Determine suitability of soil from the borrow area onsite for use in repairing the existing cap.

For the activities associated with this Task Order and SAP, main elements of the sampling design include the numbers and types of samples to be collected, sampling locations, sampling frequencies, and sample matrices. The EPA TOM has established the number of samples that will be collected, as well as the media types. If directed by the EPA TOM, EA will modify this SAP. At EPA's request, this SAP will be made available to regional, state, and local stakeholders.

The following media will be sampled during NTCRS activities at the Gulfco site:

- Wetland sediments
- Borrow area clay
- Soil borings from existing cap material.

Table 5 describes the required sample volume, containers, preservatives, and holding times for split sample analyses.

TABLE 5 ANALYTICAL PROGRAM AND METHODS

Parameter	Method	Volume and Container	Preservatives	Holding Time [(a)]
Soil/Sediment				
VOCs (soil/dry sediment)	CLP SOM01.2[b]	Option 1: At least three 40-mL glass containers with PTFE-lined septa and open tip screw-caps, pre-weighed and containing magnetic stir bars; One 4-oz glass jar with Teflon™-lined cap (filled with no headspace for determination of moisture content) Option 2: At least three 40 mL glass containers with PTFE-lined septa and open tip screw-caps, pre-weighed and containing magnetic stir bars. Two of the containers will also contain 5mL of water; One 4-oz glass jar with Teflon™-lined cap (filled with no headspace for determination of moisture content) Option 3: At least three coring tools used as transport devices; One 4-oz glass jar with Teflon™-lined cap (filled with no headspace for determination of moisture content)	Store at 4±2°C	48 hours
VOCs (wet sediment)	CLP SOM01.2[b]	Two 4-ounce glass jars with Teflon-lined caps	Store at 4±2°C	14 days
SVOCs	CLP SOM01.2[b]	One 8-ounce glass jar with Teflon-lined cap	Store at 4±2°C	14 days
Metals	CLP ISM01.2[c]	One 8-ounce glass jar with Teflon-lined cap	Store at 4±2°C	6 months
Organochlorine pesticides	CLP SOM01.2[b]	One 8-ounce glass jar with Teflon-lined cap	Store at 4±2°C	14 days
Moisture Content	ASTM D2216	One sealed 5-gallon bucket, one cubic foot of clay, for this and all following analyses		
Particle Size	ASTM D421, D422	See previous	None	None
Atterberg Limits	ASTM D423, D424	See previous	None	None
Modified Proctor	ASTM D1557	See previous	None	None
Vertical Hydraulic Conductivity	ASTM D5084	See previous	None	None

Notes:
(a) Holding time is shown as the time from sample collection to the time of sample extraction/time from sample extraction to analysis(as appropriate)
(b) EPA 2005, 2007a
(c) EPA 2010a

EA will obtain eight sediment samples, per SOP 21, 6 inches deep, from the locations shown in Figure 2 and listed in Table 6. The wetland sediment samples will be analyzed for VOCs, SVOCs, organochlorine pesticides, and total metals. The wetland sediment samples will be submitted to the CLP for analysis, and will be delivered via overnight courier.

TABLE 6 SAMPLE LOCATION COORDINATES

Cap Boring Location	**Coordinates (Latitude/Longitude)**
Central Cap Boring	28" 58' 07.35N, 95" 17' 24.08W
West Cap Boring	28" 58' 06.35N, 95" 17' 25.33W
South Cap Boring	28" 58' 06.42N, 95" 17' 23.08W
Wetland Sediment Sample Location	**Coordinates (Latitude/Longitude)**
EASED 01	28" 58' 10.33N, 95" 12' 24.23W
EASED 02	28" 58' 11.52N, 95" 17' 24.54W
EASED 03	28" 58' 07.26N, 95" 17' 18.28W
EASED 04	28" 58' 05.87N, 95" 17' 21.72W
EASED 05	28" 58' 01.08N, 95" 17' 24.79W
EASED 06	28" 58' 07.62N, 95" 17' 16.78W
EASED 07	28" 58' 07.26N, 95" 17' 18.28W
EASED 08	28" 58' 00.64N, 95" 17' 24.34W
Offsite Borrow Clay	**To be determined**

During the soil assessment, EA will visually inspect the soils for evidence of contamination. Observations and sketches of the boring locations will be included in the EA field logbook.

2.2 SAMPLING METHODOLOGY

This section briefly summarizes the procedures for sample collection, including sampling methods and equipment, sample preservation requirements, decontamination procedures, and management of IDW. Table 7 lists the SOPs that will be implemented during this field program, which are included as Appendix C.

Sample collection and handling procedures for samples that will be analyzed using CLP will follow CLP protocols as required in EPA's *Contract Laboratory Program Guidance for Field Samplers* (EPA 2007d).

Legend:

- Existing Soil Bore Location
- Proposed Soil Bore Location
- Existing Sediment Sample Location
- Proposed Sediment Sample Location
- Site Boundary (approximate)

Gulfco Marine Maintenance Superfund Site
Freeport, Brazoria County, Texas

Image Source: 2008-2009 Texas Orthoimagery Program, Texas Strategic Mapping Program, TNRIS, 2009.

Figure 2
Proposed Sample Locations
November 2010

2010-11-22 r:\federal\epa\rac iii\0064-midessa gw plume\gis\mxds\gulfcopropsampleloc.mxd EA-Dallas jschwertz

TABLE 7 STANDARD OPERATING PROCEDURES

SOP Number	SOP Title
001	Labels
002	Chain-of-Custody Form
003	Subsurface/Utility Clearance
004	Sample Packing and Shipping
005	Field Decontamination
016	Surface Water, Groundwater, and Soil/Sediment Logbooks
024	Photo-Ionization Detector
025	Soil Sampling
039	Sample Preservation and Container Requirements
042	Disposal of Investigation-Derived Material
047	Direct-Push Technology Sampling

2.2.1 Collection of Wetland Sediment Samples

The wetland sediment samples will be assessed in order to visually delineate the nature and extent of the contamination and to evaluate the underlying soil conditions through sample collection and analysis. The data will also be used to resolve any data gaps identified for the wetland areas located north of Marlin Avenue following evaluation of the recent data collected by the PRP.

2.2.2 Collection of Borrow Area Clay Samples

EA will collect two clay samples to a depth of one foot, using a shovel to fill a five gallon bucket, from the offsite borrow area in order to evaluate the usability of the material for capping purposes, at locations to be determined.

Table 5 describes the required sample volume, containers, preservatives, and holding times for chemical sample analyses. The samples will be analyzed for VOCs, SVOCs, organochlorine pesticides, and total metals. In addition, two bulk clay samples (approximately five gallons each, cubic foot) will be collected from the borrow area and analyzed by an non-CLP offsite laboratory for physical parameters, such as moisture content (ASTM D2216), particle size (ASTM D421 and D422), Atterberg limits (ASTM D423 and D424), modified proctor (ASTM D1557), and vertical hydraulic conductivity (ASTM D5084).

2.2.3 Collection of Soil Cores from Former Surface Impoundment Area

EA will obtain three soil cores from locations presented on Figure 2 and listed in Table 6, using Shelby tubes and direct push technology. The cores will be submitted to an non-CLP offsite laboratory for vertical hydraulic conductivity testing (ASTM D5084), and will be delivered to the non-CLP subcontracted laboratory via overnight courier. The cores will be obtained from 3-

inch diameter Shelby tubes advanced no deeper than 5 ft into the cap of the former surface impoundment area.

2.2.4 Sample Container, Volume, Preservation, and Holding Time Requirements

The required sample volume, container type, preservation technique, and holding time for each analysis to be conducted for samples is presented in Table 5. Required containers, preservation techniques, and holding times for field QC samples, such as field duplicates, field blanks, trip blanks, and MS/MSD samples, will be the same as for field samples.

2.2.5 Decontamination

Decontamination of the equipment will follow general practices listed in SOP No. 005 (Appendix C). Cleaned equipment will not be handled with soiled gloves. All water derived from decontamination will be collected and temporarily stored at the staging area established by the PRP for characterization.

2.2.6 Investigation-Derived Waste

All decontamination and purge water generated during the various phases of work will be suitably disposed. Any necessary IDW characterization samples will be analyzed using an EA-subcontracted laboratory.

2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Each sample collected by EA will be traceable from the point of collection through analysis and final disposition to ensure sample integrity. Sample integrity helps to ensure the legal defensibility of the analytical data and subsequent conclusions. Sample handling will follow CLP protocols as required in EPA's *Contract Laboratory Program Guidance for Field Samplers* (EPA 2007d).

EA will use EPA's data management system known as "Forms II Lite" to generate all chain-of-custody records in the field. Applicable copies of generated Forms II Lite files will be delivered to EPA data management personnel as required by CLP protocols. EA's field team will follow SOPs found in Appendix C.

2.3.1 Sample Documentation

Documentation during sampling is essential to ensure proper sample identification. EA personnel will adhere to the following general guidelines for maintaining field documentation:

- Documentation will be completed in permanent ink.
- All entries will be legible.
- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout.

- Any serialized documents will be maintained at EA and referenced in the site logbook.
- Unused portions of pages will be crossed out, and each page will be signed and dated.

The EA field representative is responsible for ensuring that sampling activities are properly documented.

2.3.1.1 Sample Labels

A sample label will be affixed to each sample container. The label will be completed with the following information written in indelible ink:

- Project name and location
- Sample identification number
- Date and time of sample collection
- Sample collector's initials
- Analysis required.

2.3.1.2 Chain-of-Custody

EA will use standard sample custody procedures to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Chain-of-custody procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The chain-of-custody record will be used to document all samples collected and the analysis requested. Information that the field personnel will record on the chain-of-custody record includes:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample identification number
- Date and time of collection
- Analysis requested
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Airbill number (if applicable)

- Project contact and phone number.

Unused lines on the chain-of-custody record will be crossed out. Field personnel will sign chain-of-custody records that are initiated in the field, and the airbill number will be recorded. The record will be placed in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed airbills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the chain-of-custody record and the airbill will be retained and filed by field personnel before the containers are shipped.

The following procedures will be implemented when samples collected during this project are shipped to analytical laboratories (with shipping considerations applicable to laboratories other than geotechnical laboratories):

- The shipping box will be filled with bubble wrap, sample bottles, and packing material. Sufficient packing material will be used to prevent sample containers from breaking during shipment.

- The chain-of-custody records will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid. The airbill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.

- The shipping box will be closed and taped shut with strapping tape around both ends.

- Signed and dated custody seals will be placed on the front and side of each shipping box. Wide clear tape will be placed over the seals to prevent accidental breakage.

- The chain-of-custody record will be transported within the taped sealed shipping box. When the shipping box is received at the analytical laboratory, laboratory personnel will open the shipping box and sign the chain-of-custody record to document transfer of samples.

Sample handling procedures for geotechnical samples will be in accordance with the relevant ASTM methods.

2.4 ANALYTICAL METHODS REQUIREMENTS

The source of analytical services to be provided will be determined in part by DQOs and the intended use of the resulting data. EA will use EPA-approved methods for laboratory analyses of the samples.

EA will follow the analytical services request procedures that are outlined EA's Analytical Services Delivery Plan (EA 2005). If an analytical system fails, the QA Officer will be notified, and corrective action will be taken. In general, corrective actions will include stopping the analysis, examining instrument performance and sample preparation information, and determining the need to re-prepare and reanalyze the samples.

2.4.1 Field Analytical Methods

EA may also field screen soil samples for organic vapors using a photoionization detector.

2.4.2 Laboratory Analytical Methods

Fixed laboratory analyses of samples will be conducted using a CLP laboratory. Table 5 outlines the anticipated laboratory analytical methods for samples collected by EA. In all cases, appropriate methods of sample preparation, cleanup, and analyses are based on specific analytical parameters of interest, sample matrices, and required detection limits.

2.5 QUALITY CONTROL REQUIREMENTS

Various field and laboratory QC samples and measurements will be used to verify that analytical data meet the QA objectives. Field QC samples and measurements will be collected to assess the influence of sampling activities and measurements on data quality. Similarly, laboratory QC samples will be used to assess how the laboratory's analytical program influences data quality. This section describes the QC samples that are to be analyzed during the investigation oversight activities for: (1) each field and laboratory environmental measurement method; and (2) each sample matrix type. Table 8 provides a summary of the types and frequency of collection of field QC samples anticipated for EA samples.

TABLE 8 FREQUENCY OF FIELD QUALITY CONTROL SAMPLES

Field QC Sample	Frequency [a]
Trip blank	1 per cooler containing aqueous samples for VOC analysis
Field blank	1 per day, if site conditions render this sample necessary
Field duplicate	1 per 10 samples
Equipment rinsate blank	1 per non-dedicated equipment type per day or 1 per 20 samples
MS/MD [b] (inorganics)	1 per 20 samples (or per EPA Region 6 Laboratory requirements)
MS/MSD[b] (organics)	1 per 20 samples (or per EPA Region 6 Laboratory requirements)
Temperature blank	1 per cooler

Notes:
[a] The QC sample collection frequency applies to samples collected for fixed-laboratory analysis (EPA 2005; 2007a; 2010a).
[b] MS, MSD, and MD analyses are technically not field QC samples; however, they generally require that the field personnel collect additional volumes of samples and are, therefore, included on this table for easy reference.

Table 3 summarizes the acceptance criteria for each type of QC sample.

2.5.1 Field Quality Control Requirements

Field QC samples will be collected and analyzed to assess the quality of data that are generated by sampling activities. These samples will include laboratory QC samples collected in the field, field duplicates, equipment rinsates, MS/MSDs, and temperature blanks. QC samples collected in the field for fixed-laboratory analysis are presented in Table 8.

Contamination can be introduced from many external sources during collection of field samples. Field blanks will be collected based on field conditions—that is, if either winds or construction that create dust are encountered during sampling.

Field duplicates are independent samples that are collected as close as possible, in space and time, to the original investigative sample. Field duplicates can measure the influence of sampling and field procedures on the precision of an environmental measurement. They can also provide information on the heterogeneity of a sampling location. Field duplicates will be collected at a frequency of one for every 10 aqueous samples, as listed in Table 8. Immediately following collection of the original sample, the field duplicates are collected using the same collection method.

Equipment rinsate blanks are collected when non-dedicated or non-disposable sampling equipment is used to collect samples and put the samples into containers. These blanks assess the cleanliness of the sampling equipment and the effectiveness of equipment decontamination. Equipment rinsate blanks are collected by pouring analyte-free water over the decontaminated surfaces of sampling equipment that contacts sampling media. Equipment rinsate blanks are collected after sampling equipment has been decontaminated, but before the equipment is reused for sampling. If non-dedicated or non-disposable equipment is used, equipment rinsate blanks will be collected at a frequency as listed in Table 8.

MS and MSD samples are laboratory QC samples that are collected for organic methods. MS and laboratory duplicate samples are typically collected for analysis of inorganics. For aqueous samples, MS/MSDs require double or triple the normal sample volume, depending on analytical laboratory specifications. Each MS and laboratory duplicate sample is one sample, usually collected from one location at double the normal sample volume. In the laboratory, MS/MSDs and MSs are split and spiked with known amounts of analytes. Analytical results for MS/MSDs and MSs and laboratory duplicate samples are used to measure the precision and accuracy of the laboratory's organic and inorganic analytical programs, respectively. Each of these QC samples will be collected and analyzed at a frequency of one for every 20 investigative samples for CLP laboratories or subcontract non-CLP laboratories.

Temperature blanks are containers of deionized or distilled water that are placed in each cooler shipped to the laboratory. Their purpose is to provide a container to test the temperature of the samples in the respective cooler.

2.5.2 Laboratory Quality Control Requirements

All laboratories that perform analytical work under this project must adhere to a QA program that is used to monitor and control all laboratory QC activities. Each laboratory must have a written QA manual that describes the QA program in detail. The laboratory QA Manager is responsible for ensuring that all laboratory internal QC checks are conducted in accordance with EPA methods and protocols, the laboratory's QA manual, and the requirements of this SAP.

Many of the laboratory QC procedures and requirements are described in EPA-approved analytical methods, laboratory method SOPs, and method guidance documents.

The EPA methods specify the preparation and analysis of QC samples, and may include, but are not limited to, the following types: (1) LCS, (2) method blanks, (3) MS, MSD, and MD samples, (4) surrogate spikes, and (5) standard reference materials or independent check standards. The following subsections discuss the QC checks that will be required for this project.

2.5.2.1 Laboratory Control Sample

Laboratory control samples are thoroughly characterized laboratory-generated samples that are used to monitor the laboratory's day-to-day performance of analytical methods. The results of LCS analyses are compared to well-defined laboratory control limits to determine whether the laboratory system is in control for the particular method. If the system is not in control, corrective action will be implemented. Appropriate corrective actions will include: (1) stopping the analysis, (2) examining instrument performance or sample preparation and analysis information, and (3) determining whether samples should be re-prepared or reanalyzed.

2.5.2.2 Method Blanks

Method blanks, which are also known as preparation blanks, are analyzed to assess the level of background interference or contamination in the analytical system and the level that may lead to elevated concentration levels or false-positive data. Method blanks will be required for all laboratory analyses and will be prepared and analyzed at a frequency of one method blank per every 20 samples or one method blank per batch, if the batches consist of fewer than 20 samples. A method blank consists of reagents that are specific to the analytical method and are carried through every aspect of the analytical procedure, including sample preparation, cleanup, and analysis. The results of the method blank analysis will be evaluated in conjunction with other QC information to determine the acceptability of the data generated for that batch of samples. Ideally, the concentration of a target analyte in the method blank will be below the reporting limit for that analyte. For some common laboratory contaminants, a higher concentration may be allowed.

If the method blank for any analysis is beyond control limits, the source of contamination must be investigated, and appropriate corrective action must be taken and documented. This investigation includes an evaluation of the data to determine the extent of the contamination and its effect on sampling results. If a method blank is within control limits but analysis indicates a concentration of analytes that is above the reporting limit, an investigation should be conducted to determine whether any corrective action could eliminate an ongoing source of target analytes.

For organic and inorganic analyses, the concentration of target analytes in the method blank must be below the reporting limit for that analyte for the blank to be considered acceptable. An exception may be made for common laboratory contaminants (such as methylene chloride, acetone, 2-butanone, and phthalate esters) that may be present in the blank at up to five times the reporting limit. These compounds are frequently detected at low levels in method blanks from materials that are used to collect, prepare, and analyze samples for organic parameters.

2.5.2.3 Matrix Spikes and Matrix Spike Duplicates

MS and MSD are aliquots of an environmental sample to which known concentrations of target analytes and compounds have been added. The MS is used to evaluate the effect of the sample matrix on the accuracy of the analysis. If there are many target analytes, they will be divided into 2-3 spike standard solutions. Each spike standard solution will be used alternately. The MS, in addition to an unspiked aliquot, will be taken through the entire analytical procedure, and the recovery of the analytes will be calculated. Results will be expressed in terms of percent recoveries and RPD. The percent recoveries of the target analytes and compounds are calculated and used to determine the effects of the matrix on the precision and accuracy of the method. The RPD between the MS and MSD results is used to evaluate method precision.

The MS/MSD is divided into three separate aliquots, two of which are spiked with known concentrations of target analytes. The two spiked aliquots, in addition to an unspiked sample aliquot, are analyzed separately, and the results are compared to determine the effects of the matrix on the precision and accuracy of the analysis. Results will be expressed as RPD and percent recovery and compared to control limits that have been established for each analyte. If results fall outside control limits, corrective action will be performed.

2.5.2.4 Laboratory (Matrix) Duplicates

MDs, which are also called laboratory duplicates, are prepared and analyzed for inorganic analyses to assess method precision. Two aliquots of sample material are taken from the sample and processed simultaneously without adding spiking compounds. The MD and the original sample aliquot are taken through the entire analytical procedure, and the RPD of the duplicate result is calculated. Results are expressed as RPD and are compared to control limits that have been established for each analyte.

2.5.2.5 Surrogate Spikes

Surrogates are organic compounds that are similar to the analytes of interest in chemical properties but are not normally found in environmental samples. Surrogates are added to field and QC samples, before the samples are extracted, to assess the efficacy of the extraction procedure and to assess the bias that is introduced by the sample matrix. Results are reported in terms of percent recovery. Individual analytical methods may require sample reanalysis based on surrogate criteria.

The laboratory will use surrogate recoveries mainly to assess matrix effects on sample analysis. Obvious problems with sample preparation and analysis (such as evaporation to dryness or a leaking septum) that can lead to poor surrogate spike recoveries must be eliminated before low surrogate recoveries can be attributed to matrix effects.

2.6 INSTRUMENT AND EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

This section outlines testing, inspection, and maintenance procedures for field equipment and instruments and for laboratory instruments.

2.6.1 General Requirements

Testing, inspection, and maintenance methods and frequency will be based on: (1) type of instrument; (2) instrument's stability characteristics; (3) required accuracy, sensitivity, and precision of the instrument; (4) instrument's intended use, considering project-specific DQOs; (5) manufacturer's recommendations; and (6) other conditions that affect measurement or operational control. For most instruments, preventive maintenance is performed in accordance with procedures and schedules recommended in: (1) the instrument manufacturer's literature or operating manual, or (2) SOPs associated with particular applications of the instrument.

In some cases, testing, inspection, and maintenance procedures and schedules will differ from the manufacturer's specifications or SOPs. This can occur when a field instrument is used to make critical measurements or when the analytical methods that are associated with a laboratory instrument require more frequent testing, inspection, and maintenance.

2.6.2 Field Equipment and Instruments

If field equipment or instruments become necessary to conduct the oversight activities, EA will maintain the field equipment as described below.

Leased field equipment and instruments will be used to conduct field oversight activities. The vendor will be responsible for thoroughly checking and calibrating field equipment and instruments before they are shipped or transported to the field. Copies of testing, inspection, and maintenance procedures will be shipped to the field with the equipment and instruments.

After the field equipment and instruments arrive in the field, they will be inspected for damage. Damaged equipment and instruments will be replaced or repaired immediately. Battery-operated equipment will be checked to ensure full operating capacity; if needed, batteries will be recharged or replaced.

Following use, field equipment will be decontaminated properly before being returned to the source. When the equipment is returned, copies of any field notes regarding equipment problems will be included so that problems are not overlooked and any necessary equipment repairs are performed.

2.6.3 Laboratory Instruments

All laboratories that analyze samples collected under the EPA Region 6 RAC 2 program must have a preventive maintenance program that addresses: (1) testing, inspection, and maintenance procedures; and (2) the maintenance schedule for each measurement system and required support activity. This program is usually documented by an SOP for each analytical instrument that is to be used. Typically, the program will be laboratory-specific; however, it should follow requirements outlined in EPA-approved guidelines. Some of the basic requirements and components of such a program are as follows:

- As a part of its QA/QC program, each laboratory will conduct a routine preventive maintenance program to minimize instrument failure and other system malfunction.
- An internal group of qualified personnel will maintain and repair instruments, equipment, tools, and gauges. Alternatively, manufacturers' representatives may provide scheduled instrument maintenance and emergency repair under a repair and maintenance contract.
- The laboratory will perform instrument maintenance on a regularly scheduled basis. The scheduled service of critical items should minimize the downtime of the measurement system. The laboratory will prepare a list of critical spare parts for each instrument. The laboratory will request the spare parts from the manufacturer and will store the parts.
- Testing, inspection, and maintenance procedures described in laboratory SOPs will be performed in accordance with manufacturer's specifications and the requirements of the specific analytical methods that are used.
- All maintenance and service must be documented in service logbooks (or the site-specific log book) to provide a history of maintenance records. A separate service logbook should be kept for each instrument; however, due to the limited scope of this project, the service records will be maintained in the site-specific field log book. All maintenance records will be traceable to the specific instrument, equipment, tool, or gauge.
- The laboratory will maintain and file records that are produced as a result of tests, inspections, or maintenance of laboratory instruments. These records will be available for review by internal and external laboratory system audits that are conducted under the EPA Region 6 RAC 2 program.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

This section describes the procedures for maintaining the accuracy of field equipment and laboratory instruments that are used for field tests and laboratory analyses. The equipment and instruments should be calibrated before each use or, when not in use, on a scheduled periodic basis.

2.7.1 Field Equipment

EA will be required to conduct field activities using the equipment calibration procedure described below.

Equipment will be maintained and calibrated with sufficient frequency and in such a manner that the accuracy and reproducibility of results are consistent with the manufacturer's specifications and with project-specific DQOs. Upon arrival of the field sampling and measurement equipment, EA field personnel will examine it to verify that it is in good working condition. The manufacturer's operating manual and instructions that accompany the equipment will be consulted to ensure that all calibration procedures are followed. Measuring and testing equipment may be calibrated either internally—by using in-house reference standards—or externally—by agencies, manufacturers, or commercial laboratories. Calibration records will contain a reference identifying the source of the procedure and, where feasible, the actual procedure. Each piece of measuring and testing equipment will also be accompanied by an equipment use log. The equipment use log (which may be contained within the site-specific field log book) will be kept current and may contain the following information: (1) date of use, (2) times of use, (3) operating and assisting technicians, (4) calibration status, and (5) comments.

2.7.2 Laboratory Instruments

All laboratory equipment that is used to analyze samples collected under the EPA Region 6 RAC 2 program will be calibrated on the basis of written SOPs that are maintained by the laboratory. Calibration records (including the dates and times of calibration and the names of the personnel performing the calibration) will be filed at the location at which the analytical work was performed and maintained by the laboratory personnel who performed QC activities. Subcontractor laboratories may conduct laboratory work under the EPA Region 6 RAC 2 program. The laboratory QA Manager is responsible for ensuring that all laboratory instruments are calibrated in accordance with the requirements of this SAP.

The laboratories will follow the method-specific calibration procedures and requirements for laboratory measurements. Calibration procedures and requirements will also be provided, as appropriate, for laboratory support equipment, such as balances, mercury thermometers, pH meters, and other equipment that is used to take chemical and physical measurements.

2.8 REQUIREMENTS FOR INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

The EA Project Manager is responsible for identifying the types and quantities of supplies and consumables that are needed for collecting the split samples for this Task Order. The Project Manager is also responsible for determining acceptance criteria for these items. Supplies and consumables can be received at either an equipment distribution center or a site. When supplies are received, the EA field personnel will sort the supplies according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before the supplies are accepted for use on a project. If the supplies do not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order. In addition, a form will be completed describing the problem and circumstances, and noting the purchase order number of the item. Afterward, the item will be returned to the vendor for replacement or repair.

2.9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

For this project, EA anticipates acquiring data from non-direct measurements such as databases, spreadsheets, and literature files.

2.10 DATA MANAGEMENT

Data for this project will be obtained from a combination of sources, including field measurements, a CLP laboratory, and the subcontracted laboratories. The data-gathering process requires a coordinated effort and will be conducted by project staff members in conjunction with all potential data producers. The data will be obtained from the analytical service provider, when appropriate, in the form of an electronic data deliverable, in addition to the required hard copy analytical data package. Formal verification (or validation) of data will be conducted before associated results are presented or are used in subsequent activities.

Data tracking is essential to ensure timely, cost-effective, and high-quality results. Data tracking begins with sample chain of custody. When the analytical service provider receives custody of the samples, the provider will send a sample acknowledgment to EA. The sample acknowledgment will confirm sample receipt, condition, and required analyses. The EPA tracking software (Forms II Lite) will contain all pertinent information about each sample and can track the data at each phase of the process. The tracking software carries the data through completion of the data validation.

EA will validate 10 percent of the investigative analytical data received from subcontract laboratories (other than the EPA Region 6 Houston laboratory or CLP laboratories) to ensure that the confirmatory data are accurate and defensible, as described in Section 4 of this SAP. A partial review will be conducted on the remaining 90 percent of the data received from subcontract laboratories. All data will be evaluated for usability by EA.

As a part of the data validation process, electronic data deliverables will be reviewed against hard copy deliverables to ensure accurate transfer of data. In addition, the hard copy will be evaluated for errors in the calculation of results. After the data validation, qualifiers can be placed on the data to indicate the usability of the data. These qualifiers will be placed into an electronic data file. Upon approval of the data set with the appropriate data qualifiers, the electronic data will be released to the Project Manager for reporting.

3. ASSESSMENT AND OVERSIGHT

This section describes the field and laboratory assessments that may be conducted during this project, the individuals responsible for conducting assessments, corrective actions that may be implemented in response to assessment results, and how quality-related issues will be reported to EA and EPA.

3.1 ASSESSMENT AND RESPONSE ACTIONS

Under the EPA Region 6 RAC 2 program, performance and system audits of field and laboratory activities may be conducted to verify that sampling and analysis are performed in accordance with the following:

- Performance and system audits
    - Audit personnel
    - Audit scope of work
    - Audit frequencies
    - Audit reports
- Corrective action
    - Sample collection and field measurements
    - Laboratory analyses.

Non-conforming items and activities are those that do not meet the project requirements, procurement document criteria, and approved work procedures. Non-conformance may be detected and identified by the following personnel:

- Project Personnel—During field operations, supervision of subcontractors, and field inspections
- Testing Personnel—During preparation for and performance of tests, equipment calibration, and QC activities
- QA Personnel—During the performance of audits, surveillance, and other QA activities.

Each non-conformance that affects quality will be documented by the person who identifies or originates the nonconformance. Documentation of nonconformance will include the following components:

- Description of nonconformance
- Identification of personnel who are responsible for correcting the nonconformance and, if verification is required, for verifying satisfactory resolution

- Method(s) for correcting the nonconformance (corrective action) or description of the variance granted
- Proposed schedule for completing corrective action and the corrective action taken.

Non-conformance documentation will be made available to the Project Manager, QA Manager, and subcontractor (e.g., non-CLP subcontract laboratories) management personnel, as appropriate.

The field personnel and QA personnel, as appropriate, are responsible for notifying the Project Manager and the QA Manager of the non-conformance. In addition, the Project Manager and the project staff, as appropriate, will be notified of significant non-conformances that could affect the results of the work. The Project Manager is responsible for determining whether notification of EPA is required.

The completion of corrective actions for significant non-conformances will be documented by QA personnel during future auditing activities. Any significant recurring non-conformance will be evaluated by project and QA personnel, as appropriate, to determine its cause. Appropriate changes will be instituted, under corporate or project procedures, to prevent recurrence. When such an evaluation is performed, the results will be documented.

3.2 REPORTS TO MANAGEMENT

Effective management of environmental data collection operations requires timely assessment and review of measurement activities. It is essential that open communication, interaction, and feedback be maintained among all project participants, including the: (1) EA QA Manager, Program Manager, Project Manager, technical staff, and laboratory subcontractors; and (2) EPA Region 6 TOM and QA Officer. EA prepares monthly progress reports for each Task Order that is conducted under the EPA Region 6 RAC 2 program. These reports address any QA issues that are specific to the Task Order and facilitate timely communication of such issues.

At the program level, the QA Manager prepares quarterly status reports of QA issues that are related to EA's work on the EPA Region 6 RAC 2 program. These reports are distributed to EA's President, corporate QA Manager, RAC 2 Program Manager, and, upon request, the EPA Region 6 Project Officer. QA status reports address the following areas:

- Results of QA audits and other inspections, including any quality improvement opportunities that have been identified for further action
- Instrument, equipment, or procedural problems that affect QA
- Subcontractor performance issues
- Corrective actions
- Status of previously reported activities and continuous quality improvement initiatives
- Work planned for the next reporting period.

4. DATA VALIDATION AND USABILITY

This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discussed procedures for verifying that the data are sufficient to meet DQOs and measurement quality objectives for the project.

Section 4.1 focuses on data review and reduction requirements for work conducted under the EPA Region 6 RAC 2 program. Section 4.2 addresses data validation and verification requirements. Section 4.3 addresses reconciliation with DQOs.

4.1 DATA REVIEW AND REDUCTION REQUIREMENTS

Data reduction and review are essential functions for preparing data that can be used effectively to support project decisions and DQOs. These functions must be performed accurately and in accordance with EPA-approved procedures and techniques. Data reduction includes all computations and data manipulations that produce the final results that are used during the investigation. Data review includes all procedures that field or laboratory personnel conduct to ensure that measurement results are correct and acceptable in accordance with the QA objectives that are stated in this SAP. Field and laboratory measurement data reduction and review procedures and requirements are specified in previously discussed field and laboratory methods, SOPs, and guidance documents.

Field personnel will record, in a field logbook and/or on the appropriate field form, all raw data from chemical and physical field measurements. The EA field representative has the primary responsibility for: (1) verifying that field measurements were made correctly, (2) confirming that sample collection and handling procedures specified in this task order-specific SAP were followed, and (3) ensuring that all field data reduction and review procedures requirements were followed. The EA field representative is also responsible for assessing preliminary data quality and for advising the data user of any potential QA/QC problems with field data. If field data are used in a project report, data reduction methods will be fully documented in the report.

The Region 6, CLP laboratories, and/or subcontracted non-CLP laboratories will complete data reduction for chemical and physical laboratory measurements and will complete an in-house review of all laboratory analytical results. The Laboratory QA Manager will be responsible for ensuring that all laboratory data reduction and review procedures follow the requirements that are stated in this SAP. The Laboratory QA Manager will also be responsible for assessing data quality and for advising the EA QA Manager of possible QA/QC problems with laboratory data.

4.2 VALIDATION AND VERIFICATION METHODS

All data that are used to support activities under the EPA Region 6 RAC 2 program must be valid for their intended purposes. This section outlines the basic data validation procedures that will be followed for all field and laboratory measurements. The following subsections identify personnel who are responsible for data validation and the general data validation process and EPA data validation guidance that will be followed.

4.2.1 Data Validation Responsibilities

When analytical services are provided by laboratories subcontracted by EA, EA is responsible for data validation. The QA Manager has primary responsibility for coordinating EA's data validation activities. EA will conduct full validation on 10 percent of all subcontracted laboratory data for investigation samples. Partial validation will be conducted on the remaining 90 percent of all subcontracted laboratory data. Data validation and review will be completed by one or more experienced data reviewers. When data is generated by the EPA Region 6 laboratory in Houston, Texas, it will be used as received from the laboratory, with no further validation. Data from CLP laboratories are validated by EPA's Environmental Services Assistance Team.

4.2.2 Data Validation Procedures

The validity of a data set is determined by comparing the data with a predetermined set of QC limits. EA data reviewers will conduct a systematic review of the data for compliance with established QC limits (such as sensitivity, precision, and accuracy), on the basis of spike, duplicate, and blank sampling results that are provided by the laboratory. The data review will identify any out-of-control data points or omissions. EA data reviewers will evaluate laboratory data for compliance with the following information:

- Method and project-specific analytical service requests
- Holding times
- Initial and continuing calibration acceptance criteria
- Field, trip, and method blank acceptance criteria
- Surrogate recovery
- Field duplicates and MS and MSD acceptance criteria
- MD precision
- LCS accuracy
- Other laboratory QC criteria specified by the method or on the project-specific analytical service request form
- Compound identification and quantitation
- Overall assessment of data, in accordance with project-specific objectives.

EA will follow the most current EPA CLP guidelines (EPA 2008 and 2010b) for completing data validation for all applicable test methods. General procedures in the CLP guidelines will be modified, as necessary, to fit the specific analytical method that is used to produce the data. In all cases, data validation requirements will depend on: (1) DQO levels that are defined in Section 1.3, (2) reporting requirements that are defined in Section 1.5, and (3) data deliverables that are requested from the laboratory, as discussed in Section 1.5.

4.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The main purpose of a QA system is to define a process for collecting data that are of known quality, are scientifically valid, are legally defensible, and fully support decisions that will be based on the data. To achieve this purpose, the QAPP requires that DQOs be fully defined (Section 1.3). Other parts of the QA system must then be planned and implemented in a manner that is consistent with the DQOs. QA system components that follow directly from the DQOs include documentation and reporting requirements (Section 1.5), sample process design and sampling methods requirements (Sections 2.1 through 2.4), analytical methods and analytical service requests (Section 2.5), QC requirements (Section 2.6), and data reduction and validation and reporting methods (Sections 4.1 and 4.2).

After environmental data have been collected, reviewed, and validated, the data will undergo a final evaluation to determine whether the DQOs specified in this QAPP have been met. EA will follow EPA's data quality assessment process to verify that the type, quality, and quantity of data that are collected are appropriate for their intended use (EPA 2006b; 2006c).

The data quality assessment process involves (1) verifying that the data have met the assumptions under which the data collection design and DQOs were developed, (2) taking appropriate corrective action if the assumptions have not been met, and (3) evaluating the extent to which the data support the decision that must be made so that scientifically valid and meaningful conclusions can be drawn from the data. To the extent possible, EA will follow DQA methods and procedures that have been outlined by EPA (2006b; 2006c).

When the five-step data quality assessment process is not completely followed because the DQOs are qualitative, EA will systematically assess data quality and data usability. This assessment will include:

- A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives.
- A review of project-specific data quality indicators for PARCCS to determine whether acceptance criteria have been met.
- A review of project-specific DQOs to determine whether they have been achieved by the data collected.
- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared to a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

EA will compile analytical and field data into a format that is compatible with EPA Region 6 or National Electronic Data Management Network. EA will use the data to prepare the following documents:

- Data Validation Report
- Data Evaluation Summary Report
- EE/CA Report
- Action Memorandum

The specific requirements and elements of each of these reports are discussed in detail in the EPA-approved RI/FS Work Plan (EA 2010b).

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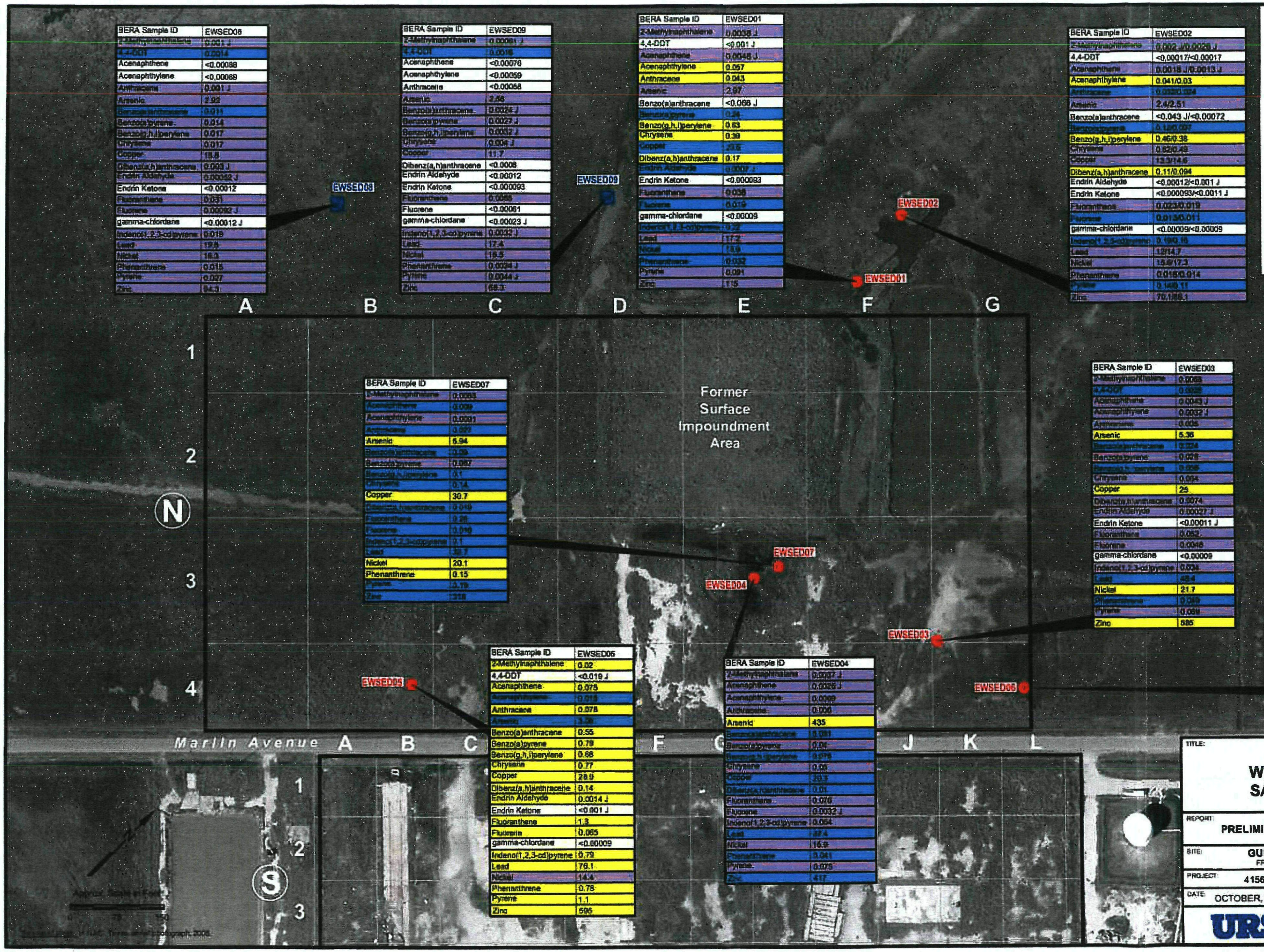
Appendix A
FIGURE (PRP Wetland Sediment Sample Locations)



BERA Sample ID	EWSED08
2-Methylnaphthalene	0.001 J
4,4-DDT	0.0014
Acenaphthene	<0.00088
Acenaphthylene	<0.00069
Anthracene	0.001 J
Arsenic	2.92
Benzo(a)anthracene	0.011
Benzo(a)pyrene	0.014
Benzo(g,h,i)perylene	0.017
Chrysene	0.017
Copper	18.8
Dibenz(a,h)anthracene	0.003 J
Endrin Aldehyde	0.00052 J
Endrin Ketone	<0.00012
Fluoranthene	0.031
Fluorene	0.00092 J
gamma-chlordane	<0.00012 J
Indeno(1,2,3-cd)pyrene	0.019
Lead	19.5
Nickel	16.3
Phenanthrene	0.015
Pyrene	0.027
Zinc	94.3

BERA Sample ID	EWSED09
2-Methylnaphthalene	0.00061 J
4,4-DDT	0.0016
Acenaphthene	<0.00076
Acenaphthylene	<0.00059
Anthracene	<0.00058
Arsenic	2.56
Benzo(a)anthracene	0.0024 J
Benzo(a)pyrene	0.0027 J
Benzo(g,h,i)perylene	0.0032 J
Chrysene	0.004 J
Copper	11.7
Dibenz(a,h)anthracene	<0.0008
Endrin Aldehyde	<0.00012
Endrin Ketone	<0.000093
Fluoranthene	0.0055
Fluorene	<0.00061
gamma-chlordane	<0.00023 J
Indeno(1,2,3-cd)pyrene	0.0033 J
Lead	17.4
Nickel	16.5
Phenanthrene	0.0024 J
Pyrene	0.0044 J
Zinc	68.3

BERA Sample ID	EWSED01
2-Methylnaphthalene	0.0038 J
4,4-DDT	<0.001 J
Acenaphthene	0.0046 J
Acenaphthylene	0.057
Anthracene	0.043
Arsenic	2.97
Benzo(a)anthracene	<0.068 J
Benzo(a)pyrene	0.24
Benzo(g,h,i)perylene	0.63
Chrysene	0.39
Copper	23.5
Dibenz(a,h)anthracene	0.17
Endrin Aldehyde	0.0007 J
Endrin Ketone	<0.000093
Fluoranthene	0.038
Fluorene	0.019
gamma-chlordane	<0.00009
Indeno(1,2,3-cd)pyrene	0.32
Lead	17.2
Nickel	18.9
Phenanthrene	0.032
Pyrene	0.091
Zinc	115

BERA Sample ID	EWSED02
2-Methylnaphthalene	0.002 J/0.0026 J
4,4-DDT	<0.00017/<0.00017
Acenaphthene	0.0018 J/0.0013 J
Acenaphthylene	0.041/0.03
Anthracene	0.032/0.024
Arsenic	2.4/2.51
Benzo(a)anthracene	<0.043 J/<0.00072
Benzo(a)pyrene	0.12/0.097
Benzo(g,h,i)perylene	0.46/0.38
Chrysene	0.62/0.49
Copper	13.3/14.6
Dibenz(a,h)anthracene	0.11/0.094
Endrin Aldehyde	<0.00012/<0.001 J
Endrin Ketone	<0.000093/<0.0011 J
Fluoranthene	0.023/0.019
Fluorene	0.013/0.011
gamma-chlordane	<0.00009/<0.00009
Indeno(1,2,3-cd)pyrene	0.19/0.16
Lead	12/14.7
Nickel	15.8/17.3
Phenanthrene	0.016/0.014
Pyrene	0.14/0.11
Zinc	70.1/65.1

BERA Sample ID	EWSED07
2-Methylnaphthalene	0.0053
Acenaphthene	0.009
Acenaphthylene	0.0091
Anthracene	0.029
Arsenic	6.94
Benzo(a)anthracene	0.09
Benzo(a)pyrene	0.087
Benzo(g,h,i)perylene	0.1
Chrysene	0.14
Copper	30.7
Dibenz(a,h)anthracene	0.019
Fluoranthene	0.26
Fluorene	0.016
Indeno(1,2,3-cd)pyrene	0.1
Lead	32.7
Nickel	20.1
Phenanthrene	0.15
Pyrene	0.19
Zinc	318

BERA Sample ID	EWSED03
2-Methylnaphthalene	0.0068
4,4-DDT	0.0028
Acenaphthene	0.0043 J
Acenaphthylene	0.0032 J
Anthracene	0.005
Arsenic	5.36
Benzo(a)anthracene	0.024
Benzo(a)pyrene	0.028
Benzo(g,h,i)perylene	0.056
Chrysene	0.034
Copper	29
Dibenz(a,h)anthracene	0.0074
Endrin Aldehyde	0.00027 J
Endrin Ketone	<0.00011 J
Fluoranthene	0.052
Fluorene	0.0048
gamma-chlordane	<0.00009
Indeno(1,2,3-cd)pyrene	0.034
Lead	48.4
Nickel	21.7
Phenanthrene	0.089
Pyrene	0.059
Zinc	585

BERA Sample ID	EWSED06
2-Methylnaphthalene	0.0016 J
4,4-DDT	0.0012
Acenaphthene	0.0013 J
Acenaphthylene	0.0008 J
Anthracene	0.0011 J
Arsenic	3.23
Benzo(a)anthracene	0.0089
Benzo(a)pyrene	0.01
Benzo(g,h,i)perylene	0.019
Chrysene	0.014
Copper	28.1
Dibenz(a,h)anthracene	0.0026 J
Endrin Aldehyde	<0.00012
Endrin Ketone	<0.000093
Fluoranthene	0.02
Fluorene	0.001 J
gamma-chlordane	0.00025 J
Indeno(1,2,3-cd)pyrene	0.019
Lead	32.9
Nickel	22.5
Phenanthrene	0.013
Pyrene	0.021
Zinc	959

BERA Sample ID	EWSED05
2-Methylnaphthalene	0.02
4,4-DDT	<0.019 J
Acenaphthene	0.075
Acenaphthylene	0.018
Anthracene	0.078
Arsenic	3.26
Benzo(a)anthracene	0.55
Benzo(a)pyrene	0.79
Benzo(g,h,i)perylene	0.68
Chrysene	0.77
Copper	28.9
Dibenz(a,h)anthracene	0.14
Endrin Aldehyde	0.0014 J
Endrin Ketone	<0.001 J
Fluoranthene	1.3
Fluorene	0.065
gamma-chlordane	<0.00009
Indeno(1,2,3-cd)pyrene	0.79
Lead	76.1
Nickel	14.4
Phenanthrene	0.78
Pyrene	1.1
Zinc	595

BERA Sample ID	EWSED04
2-Methylnaphthalene	0.0037 J
Acenaphthene	0.0026 J
Acenaphthylene	0.0069
Anthracene	0.006
Arsenic	435
Benzo(a)anthracene	0.031
Benzo(a)pyrene	0.04
Benzo(g,h,i)perylene	0.076
Chrysene	0.05
Copper	20.3
Dibenz(a,h)anthracene	0.01
Fluoranthene	0.076
Fluorene	0.0032 J
Indeno(1,2,3-cd)pyrene	0.054
Lead	37.4
Nickel	16.9
Phenanthrene	0.041
Pyrene	0.075
Zinc	417

EXPLANATION

- Gulfco Marine Maintenance Site Boundary (approximate)
- BERA Sediment Sample Location
- BERA Sediment Reference Sample Location

Notes

J - Estimated Value

Results for duplicate samples are separated by a "/"

- = High Concentration
- = Mid Concentration
- = Low Concentration

TITLE:

WETLAND SEDIMENT SAMPLE LOCATIONS

REPORT: PRELIMINARY SITE CHARACTERIZATION REPORT

SITE: GULFCO MARINE MAINTENANCE
FREEPORT, BRAZORIA COUNTY, TEXAS

PROJECT: 41568745	DRAWN: ZGK/NAB	FIGURE: 4
DATE: OCTOBER, 2010	CHECKED: DL	

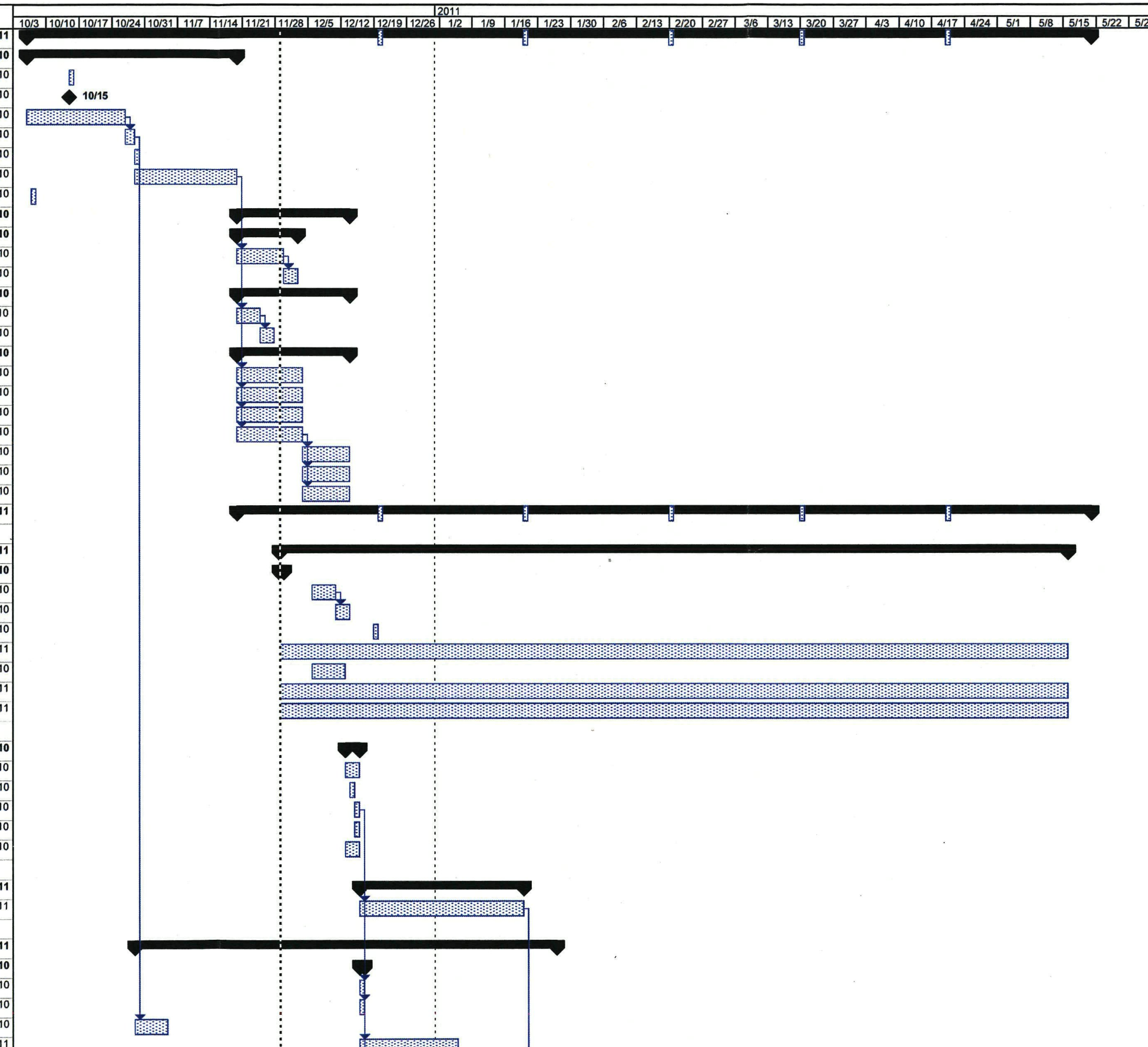
URS
10550 RICHMOND AVE., SUITE 155
HOUSTON, TEXAS 77042
PH: 713-914-6699
FAX: 713-914-8404

Appendix B

Revised Task Order Schedule

TASK ORDER SCHEDULE
EPA REGION 6, RAC2, Contract EP-W-06-004,
Gulfco Marine Maintenace Superfund Site Non-Time Critical Removal Action Support

ID	WBS	Task Name	Start	Finish
1	1	**Non-Time Critical Removal Support (NTCRS)**	**Wed 10/6/10**	**Fri 5/20/11**
2	1.1	**Project Planning and Support**	**Wed 10/6/10**	**Fri 11/19/10**
3	1.1.1	Attend Scoping Meeting (Meeting Not Warranted - Response Questions received 10/15/10)	Fri 10/15/10	Fri 10/15/10
4	1.1.2	Conduct Site Visit (Visit Not Warranted - Response Questions received 10/15/10)	Fri 10/15/10	Fri 10/15/10
5	1.1.3	Develop Work Plan and Cost Estimate (Rev 00)	Wed 10/6/10	Tue 10/26/10
6	EPA	EPA Review/Approval of Work Plan	Wed 10/27/10	Thu 10/28/10
7	1.1.3	Revise and Submit Work Plan and Cost Estimate (Rev 01)	Fri 10/29/10	Fri 10/29/10
118	EPA	EPA Review/Approval of Work Plan	Fri 10/29/10	Fri 11/19/10
8	1.1.4	Provide Conflict of Interest Disclosure	Thu 10/7/10	Thu 10/7/10
10	1.2	**Preparation of Site Specific Plans**	**Sat 11/20/10**	**Mon 12/13/10**
11	1.2.1	**Sampling and Analysis Plan (SAP)**	**Sat 11/20/10**	**Thu 12/2/10**
12	1.2.1	Draft SAP	Sat 11/20/10	Mon 11/29/10
13	EPA	EPA Review/Approval of SAP	Tue 11/30/10	Thu 12/2/10
14	1.2.2	**Health and Safety Plan**	**Sat 11/20/10**	**Mon 12/13/10**
15	1.2.2	Draft HASP	Sat 11/20/10	Wed 11/24/10
16	EPA	EPA Review/Approval of HASP	Thu 11/25/10	Sat 11/27/10
17	1.5	**Project Initiation and Support**	**Sat 11/20/10**	**Mon 12/13/10**
18	1.5.1	Develop Data Summaries	Sat 11/20/10	Fri 12/3/10
19	1.5.2	Compile Exisitng Data and Reports	Sat 11/20/10	Fri 12/3/10
20	1.5.3	Identify Significant Data Gaps	Sat 11/20/10	Fri 12/3/10
21	1.5.4	Conceptual Understanding of the Site (assumes no revisions necessary)	Sat 11/20/10	Fri 12/3/10
22	1.5.5	Identify Likely Response Scenarios	Sat 12/4/10	Mon 12/13/10
23	1.5.6	Prepare Conceptual Exposure Pathway Analysis	Sat 12/4/10	Mon 12/13/10
24	1.5.7	Initiate Identificaiton of ARARS	Sat 12/4/10	Mon 12/13/10
25	1.4	**Project Management/Submit MSR/Invoice**	**Sat 11/20/10**	**Fri 5/20/11**
33				
34	2	**Community Involvement**	**Mon 11/29/10**	**Sun 5/15/11**
108	2.3	**Provide Public Meeting/Open House Support**	**Mon 11/29/10**	**Mon 11/29/10**
35	2.4	Prepare Fact Sheets	Mon 12/6/10	Fri 12/10/10
116	EPA	EPA Review/Approval of Fact Sheets	Sat 12/11/10	Mon 12/13/10
37	2.7	Publish Public Notice in Newspaper	Sun 12/19/10	Sun 12/19/10
38	2.8	Maintain Public Information	Mon 11/29/10	Sun 5/15/11
39	2.11	Prepare Presentation materials	Mon 12/6/10	Sun 12/12/10
40	2.12	Inplement Other Community Involvement Activites	Mon 11/29/10	Sun 5/15/11
41	2.13	Provide Technical Support to Review Community Involvement Deliverables	Mon 11/29/10	Sun 5/15/11
43				
44	3	**Field Investigation and Data Acquisition**	**Mon 12/13/10**	**Wed 12/15/10**
107	10.2	Mobilization/Demobilization	Mon 12/13/10	Wed 12/15/10
45	3.3	Soil Boring, Drilling, and Testing	Tue 12/14/10	Tue 12/14/10
46	3.4	Environmental Sampling	Wed 12/15/10	Wed 12/15/10
47	3.7	IDW Disposal	Wed 12/15/10	Wed 12/15/10
48	3.8	Site Reconnissance	Mon 12/13/10	Wed 12/15/10
50				
51	4	**Sample Anaysis**	**Thu 12/16/10**	**Wed 1/19/11**
52	4.1	Sample Analysis and Production of Analytical data	Thu 12/16/10	Wed 1/19/11
53				
54	5	**Analytical Support and Data Validation**	**Fri 10/29/10**	**Wed 1/26/11**
55	5.1	**Collect, Prepare, and Ship Environmental Samples**	**Thu 12/16/10**	**Thu 12/16/10**
56	5.1.3	Surface and Subsurface Soil Sampling	Thu 12/16/10	Thu 12/16/10
57	5.1.4	Surface Water and Sediment Sampling	Thu 12/16/10	Thu 12/16/10
58	5.2	Develop DQOs	Fri 10/29/10	Thu 11/4/10
59	5.3	Oversight of Analytical Services	Thu 12/16/10	Wed 1/5/11



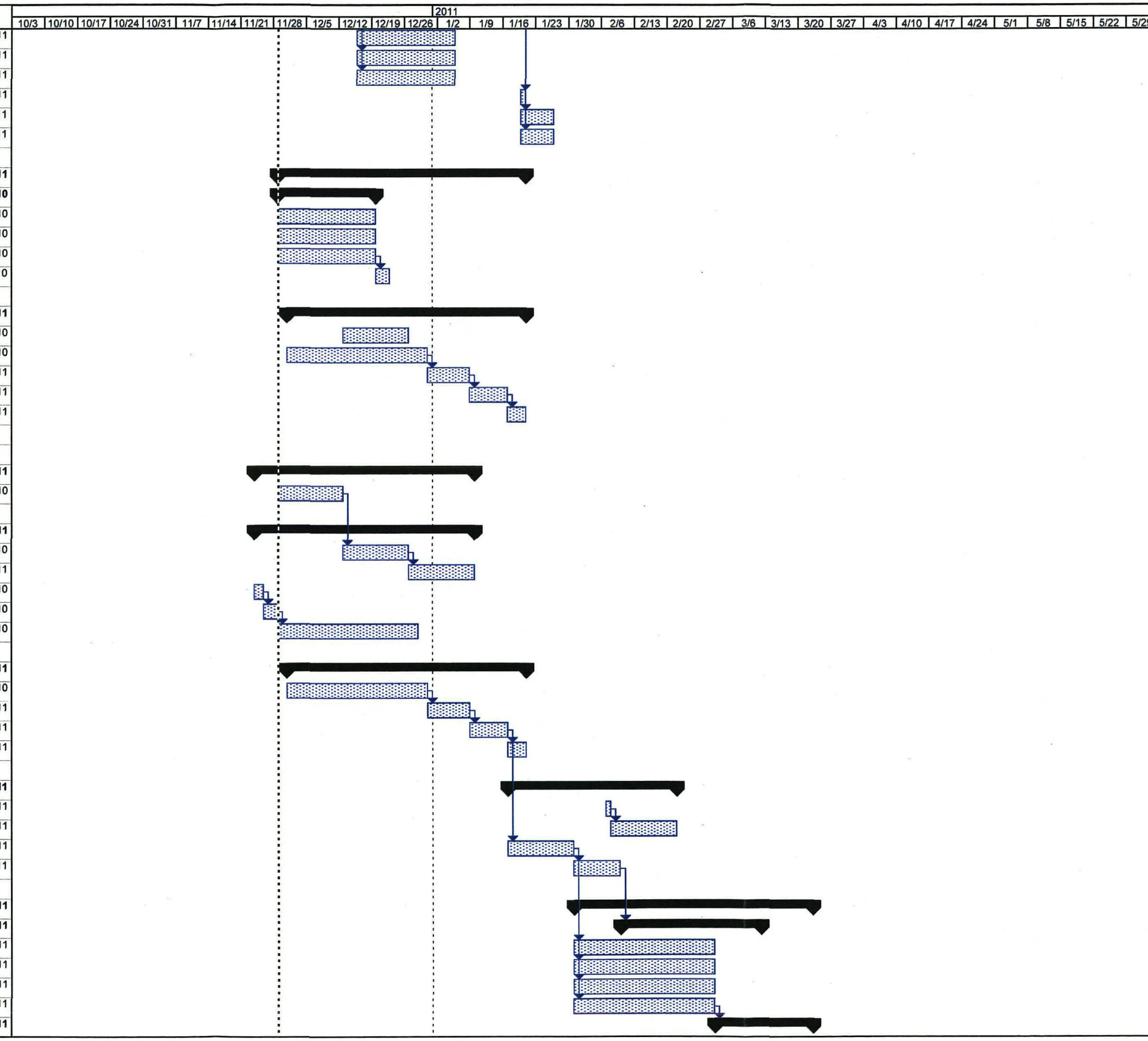
Gulfco Marine NTCRS
October 2010
Revision No. 1

Task	Progress	Summary	Rolled Up Split	Rolled Up Progress
Split	Milestone	Rolled Up Task	Rolled Up Milestone	External Tasks

Project Summary
Deadline
External Milestone

TASK ORDER SCHEDULE
EPA REGION 6, RAC2, Contract EP-W-06-004,
Gulfco Marine Maintenace Superfund Site Non-Time Critical Removal Action Support

ID	WBS	Task Name	Start	Finish
60	5.4	Coordinate with Applicable Laboratory	Thu 12/16/10	Wed 1/5/11
61	5.5	Implement EPA-Approved Laboratory QA Program	Thu 12/16/10	Wed 1/5/11
62	5.6	Provide Sample Management	Thu 12/16/10	Wed 1/5/11
63	5.7	Data Validation	Thu 1/20/11	Thu 1/20/11
64	5.8	Review Data for Usability	Thu 1/20/11	Wed 1/26/11
65	5.9	Prepare and Provide Data Validation/Usability Reports	Thu 1/20/11	Wed 1/26/11
66				
67	**6**	**Data Evaluation**	**Mon 11/29/10**	**Thu 1/20/11**
68	**6.1**	**Combine Analytical and Field Data and Produce DESR**	**Mon 11/29/10**	**Sun 12/19/10**
109	10.3.1	Data Usability Evaluation and QA/QC	Mon 11/29/10	Sun 12/19/10
69	6.1.1	Data Reduction and Tabulation	Mon 11/29/10	Sun 12/19/10
70	6.2	Data Reduction, Tabulation, and Evaluation	Mon 11/29/10	Sun 12/19/10
72	EPA	EPA Review of Data Evaluation Summary Report	Mon 12/20/10	Wed 12/22/10
73				
74	**7**	**Risk Assessment**	**Wed 12/1/10**	**Thu 1/20/11**
110	7.2	Conduct Ecological Risk Evaluation Baseline Ecological Risk Assessment	Mon 12/13/10	Sun 12/26/10
75	7.3	Prepare Draft Risk Evaluation Assesment Report (to be included with Draft EE/CA Report)	Wed 12/1/10	Thu 12/30/10
77	EPA	EPA Review of Draft Risk Evaluation Summary Report	Fri 12/31/10	Sat 1/8/11
78	7.4	Prepare Final Risk Evaluation Assesment Report (to be included with Final EE/CA Report)	Sun 1/9/11	Sun 1/16/11
79	EPA	EPA Review of Final Risk Evaluation Summary Report	Mon 1/17/11	Thu 1/20/11
80				
81				
82	**8**	**Identification of Removal Alternatives**	**Wed 11/24/10**	**Sun 1/9/11**
83	8.1	Identify and Screen Appropriate Removal Alternatives	Mon 11/29/10	Sun 12/12/10
84				
85	**9**	**Analysis of Removal Alternatives**	**Wed 11/24/10**	**Sun 1/9/11**
86	9.1	Assess Individual Removal Alternatives	Mon 12/13/10	Sun 12/26/10
87	9.2	Perform Comparative Analysis of Options	Mon 12/27/10	Sun 1/9/11
111	9.3	Recommend Treatability Studies	Wed 11/24/10	Thu 11/25/10
89	EPA	EPA Review of Treatibility Study Recommendations	Fri 11/26/10	Sun 11/28/10
90	9.4	Conduct Treatability Studies at Direction of EPA	Mon 11/29/10	Tue 12/28/10
91				
92	**10**	**Engineering Evaluation/Cost Analysis (EE/CA) Report**	**Wed 12/1/10**	**Thu 1/20/11**
93	10.1	Draft EE/CA	Wed 12/1/10	Thu 12/30/10
94	EPA	EPA Review of Draft EE/CA Report	Fri 12/31/10	Sat 1/8/11
95	10.2	Prepare Final EE/CA Report	Sun 1/9/11	Sun 1/16/11
96	EPA	EPA Review of Fina EE/CA Report	Mon 1/17/11	Thu 1/20/11
97				
98	**11**	**Post EE/CA Support**	**Mon 1/17/11**	**Mon 2/21/11**
99	11.1	Attend Public Meetings	Mon 2/7/11	Mon 2/7/11
100	11.2	Provide Techncial Assitance for Responsiveness Summary	Tue 2/8/11	Mon 2/21/11
101	11.3	Provide Techncial Assistance for Action Memorandum	Mon 1/17/11	Sun 1/30/11
102	EPA	EPA Review of Draft Action Memo	Mon 1/31/11	Wed 2/9/11
103				
104	**13**	**Task Order Closeout**	**Mon 1/31/11**	**Tue 3/22/11**
105	**13.1**	**Package and Return Documents**	**Thu 2/10/11**	**Fri 3/11/11**
112	13.2	Duplicate, Distribute, and Store Files	Mon 1/31/11	Tue 3/1/11
113	13.3	Archive Files	Mon 1/31/11	Tue 3/1/11
114	13.4	Produce EPA-Approved Data Storage Format	Mon 1/31/11	Tue 3/1/11
115	13.5	Prepare and Submit Task Order Closeout Report	Mon 1/31/11	Tue 3/1/11
117	**EPA**	**EPA Review of Task Order Cloesout Report**	**Wed 3/2/11**	**Tue 3/22/11**



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Task	Progress	Summary	Rolled Up Split	Rolled Up Progress	Project Summary	Deadline
Split	Milestone	Rolled Up Task	Rolled Up Milestone	External Tasks	External Milestone	

Appendix C

Standard Operating Procedures

Standard Operating Procedure No. 001
for
Sample Labels

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
Hunt Valley, Maryland 21031

Revision 0
August 2007

CONTENTS

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to delineate protocols for the use of sample labels. Every sample will have a sample label uniquely identifying the sampling point and analysis parameters. An example label is provided below. Other formats with similar levels of detail are acceptable.

PROJECT NAME ____________ PROJECT NUM. __________
SAMPLE LOCATION/SITE ID _________________________
DATE: ___/___/___ TIME: _____:_____
ANALYTES: METALS VOC EXPLOSIVES ORGANICS OTHER
FILTERED: [NO] [YES]
PRESERVATIVE: [NONE] [HNO_3] [OTHER _____]
SAMPLER: ___________________

2. MATERIALS

The following materials may be required: sample label and indelible laboratory marker.

3. PROCEDURE

The following sections describe how to use the sample labeling system.

3.1 LABEL INFORMATION

As each sample is collected/selected, fill out a sample label. Enter the following information on each label:

- Project name
- Project number
- Location/site identification—Enter the media type (i.e., well number, surface water, soil, etc.) sampling number, and other pertinent information concerning where the sample was taken
- Date of sample collection

- Time of sample collection
- Analyses to be performed (NOTE: Due to number of analytes, details of analysis should be arranged with laboratory *prior to start of work)*
- Whether filtered or unfiltered (water samples only)
- Preservatives (water samples only)
- Number of containers for the sample (e.g., 1 of 2, 2 of 2).

3.2 ROUTINE CHECK

Double-check the label information to make sure it is correct. Detach the label, remove the backing, and apply the label to the sample container. Cover the label with clear tape, ensuring that the tape completely encircles the container.

3.3 RECORD INFORMATION

Record the sample number and designated sampling point in the field logbook, along with the following sample information:

- Time of sample collection (each logbook page should be dated)
- Location of the sample
- Organic vapor meter or photoionization meter readings for the sample (when appropriate)
- Any unusual or pertinent observations (oily sheen on groundwater sample, incidental odors, soil color, grain size, plasticity, etc.)
- Number of containers required for each sample
- Whether the sample is a quality assurance sample (split, duplicate, or blank).

3.3.1 Logbook Entry

A typical logbook entry might look like this:

- 7:35 a.m. Sample No. MW-3. PID = 35 ppm
- Petroleum odor present. Sample designated MW-3-001.

NOTE: Duplicate samples will be given a unique sample designation rather than the actual sample number with an added prefix or suffix. This will prevent any indication to the laboratory that this is a duplicate sample. This fictitious sample number will be listed in the logbook along with the actual location of the sample.

3.4 SHIPMENT

Place the sample upright in the designated sample cooler. Make sure there is plenty of ice in the cooler at all times.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

5.1 INCIDENTAL ODORS

Note that although incidental odors should be noted in the logbook, it is unwise from a safety and health standpoint to routinely "sniff test" samples for contaminants.

5.2 DUPLICATE SAMPLE

No indication of which samples are duplicates is to be provided to the laboratory.

6. REFERENCES

U.S. Environmental Protection Agency. 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans. QAMS-005/80.

Standard Operating Procedure No. 002
for
Chain-of-Custody Form

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
Hunt Valley, Maryland 21031

Revision 0
August 2007

CONTENTS

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to delineate protocols for use of the chain-of-custody form. An example is provided as Figure SOP002-1. Other formats with similar levels of detail are acceptable.

2. MATERIALS

The following materials may be required: chain-of-custody form and indelible ink pen.

3. PROCEDURE

- Give the site name and project name/number.
- Enter the sample identification code.
- Indicate the sampling dates for all samples.
- List the sampling times (military format) for all samples.
- Indicate "grab" or "composite" sample with an "X."
- Specify the sample location.
- Enter the total number of containers per cooler.
- List the analyses/container volume.
- Obtain the signature of sample team leader.
- State the carrier service and airbill number, analytical laboratory, and custody seal numbers.
- Sign, date, and time the "relinquished by" section.
- Upon completion of the form, retain the shipper copy, and affix the other copies to the inside of the sample cooler, in a zip-seal bag to protect from moisture, to be sent to the designated laboratory.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

None.

6. REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80.

U.S. EPA. 1990. Sampler's Guide to the Contract Laboratory Program. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C. December.

U.S. EPA. 1991. User's Guide to the Contract Laboratory Program. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response. January.

Company Name:	Project Manager or Contact: Phone:	Parameters/Method Numbers for Analysis	Chain of Custody Record	EA Laboratories 19 Loveton Circle Sparks, MD 21152 Telephone: (410) 771-4950 Fax: (410) 771-4077
Project No. Dept.: Task:	Project Name:			
Sample Storage Location:	ATO Number:		**Report Deliverables:** 1 2 3 4 D E **EDD: Yes/No** **DUE TO CLIENT:** ________	
Page of	**Report #:**			

Date	Time	Water	Soil	Sample Identification 19 Characters	**No. of Containers**													**EA Labs Accession Number**	Remarks
																			LPM:

Samples by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Date/Time	Received by Laboratory: (Signature)	Date/Time	Airbill Number:	Sample Shipped by: (Circle) Fed Ex. Puro. UPS Hand Carried Other:

Cooler Temp. _______ C pH: ___ Yes ___ No Comments: Custody Seals Intact ___ Yes ___ No

NOTE: Please indicate method number for analyses requested. This will help clarify any questions with laboratory techniques.

Standard Operating Procedure No. 003
for
Subsurface/Utility Clearance

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
Hunt Valley, Maryland 21031

Revision 0
August 2007

CONTENTS

1. SCOPE AND APPLICATION

1.1 PURPOSE

The purpose of this Standard Operating Procedure is to prevent injury to workers and damage to subsurface structures (including tanks, pipe lines, water lines, gas lines, electrical service, etc.) during ground disturbance activities (including drilling, augering, sampling, use of direct-push technologies, excavation, trenching, concrete coring or removal, fence post installation, grading, or other similar operations).

1.2 LIMITATIONS

The procedures set forth in this document are the suggested procedures but may not be applicable to particular sites based on the site-specific considerations. The Project Manager is responsible for making a site-specific evaluation of each site to determine whether the Subsurface/Clearance Procedures should be utilized or require modification. If safety or other site-specific considerations require a modified or different procedure, the Project Manager should review the modified procedure with the Business Unit Director, Profit Center Manager, or Senior Technical Reviewer.

1.3 SCOPE

This procedure provides minimum guidance for subsurface clearance activities, which must be followed prior to and during ground disturbance activities at EA project sites. Even after completing the subsurface clearance activities required in this procedure, all ground disturbance activities should proceed with due caution.

Deviations from this procedure may be provided on an exception basis for specific situations, such as underground storage tank systems removals, verified aboveground/overhead services/lines, undeveloped land/idle facilities, shallow groundwater conditions, soil stability, or well construction quality assurance/quality control concerns, etc.

EA or its subcontractors are responsible for, and shall ensure that, all ground disturbance activities are completed safely, without incident, and in accordance with applicable federal, state, and local regulations.

This procedure shall not override any site-specific or consultant/contractor procedures that are more stringent or provide a greater degree of safety or protection of health or the environment.

2. PROCEDURES

The EA Project Manager or his designee must complete the Subsurface Clearance Procedure Checklist (Appendix A) in conjunction with the following procedures. The checklist must be completed before initiating any ground disturbance activities. The completed checklist must be submitted to the appropriate team individuals, subcontractors, and/or the client and included in the project files.

2.1 SAFETY

A Health and Safety Plan must be available onsite and followed by all contractors and subcontractors.

All work areas shall be defined and secured with safety cones, safety tape, construction fence, other barriers, or signs as appropriate.

Site work permits must be obtained as required by site procedures. Based on site conditions or classification, the use of intrinsically-safe equipment may be required.

To ensure the safety of all onsite personnel and subsurface structure integrity, consideration should be given to de-energizing and locking out selected site utilities or temporarily shutting down a portion of or the entire facility.

2.2 PREPARATION TASKS

Objective—To gather all relevant information about potential subsurface structures prior to the actual site visit.

2.2.1 Obtain Permits and Site Access

The consultant/contractor is responsible for following all applicable laws, guidance, and approved codes of practice; obtaining all necessary permits and utility clearances; and securing site access permission.

2.2.2 Historic Site Information

Obtain most recent as-built drawings and/or site plans (including underground storage tank, product, and vent lines) as available.

NOTE: As-built drawings may not accurately depict the locations and depths of improvements and subsurface structures and should, therefore, not be **solely** relied upon.

EA should obtain any other site information such as easements, right-of-ways, historical plot plans, fire insurance plans, tank (dip) charts, previous site investigations, soil surveys, boring logs, and aerial photographs, etc. as relevant to the planned ground disturbance activities.

Where applicable, EA should also contact contract personnel who may have historic site knowledge.

2.2.3 Mark-Outs

Objective—To identify location of subsurface structures on surface.

EA must ensure that a thorough mark-out at the site is completed to locate electrical, gas, telephone, water, sewer, low voltage electric lines, product delivery pipelines, fiber optic, and all other subsurface utilities/services.

- Where available, public utility companies must be contacted to identify underground utilities. (This can be accomplished through the One-Call system in most instances.)
- In addition, where available and warranted by site conditions, a private utility/pipeline mark-out company should be contracted to perform an electronic subsurface survey to identify the presence of suspected hazardous or critical underground utilities and subsurface structures. In some cases, this is necessary to confirm public utility mark-outs in the vicinity of planned ground disturbance activities.

EA will review all available site plan subsurface information with the private mark-out company to assist in locating utilities and other subsurface structures.

NOTE: Mark-outs may not accurately depict the exact locations of improvements and subsurface structures and should, therefore, not be **solely** relied upon.

Where possible, EA personnel are encouraged to be onsite at the time of subsurface mark-outs. This is to ensure accuracy and understanding of subsurface structures identified and provides an opportunity to exchange information with mark-out company personnel regarding planned work activities.

Subsurface structures should be marked throughout the entire work area(s) with adequate materials (e.g., site conditions may require paint and tape/flags). Ground disturbance activities must be started within 30 days of mark-out, unless local ordinances specify a shorter time period. If activities are not started within required time period or markings have faded, mark-outs must be redone.

EA personnel will record time and date of mark-out request and list all companies contacted by the service and confirmation number. This should be available for review onsite and checked off after visual confirmation of markings.

2.2.4 Initial Site Visit

Objective—To compare the site plan to actual conditions based on information gathered in Procedures 2 and 3 above, obtain additional site information needed, and prepare a vicinity map.

EA will document all findings and update the site plan with this information. On third party sites, close coordination with the site owner's representatives for mark-outs, review of as-builts, and other information reviews should be conducted prior to work. Project Managers are encouraged to provide updated as-built information to the client.

In some regions, it may be more effective and efficient to conduct the site visit at the same time the contractor and drill rig are mobilized to the site. The inspection should include the following activities and may include others as determined by the consultant/contractor and the Project Manager.

2.2.5 Utilities

EA shall perform a detailed site walk-through for the purpose of identifying all aboveground indicators of subsurface utilities/services that may be leading to or from buildings within the planned work area. The inspection shall include, but not be limited to, the following:

- Utility mark-outs
- Aboveground utilities
- Area lights/signs
- Phones
- Drains
- Junction boxes
- Natural gas meters or connections
- Other utilities including: fire hydrants, on/below grade electrical transformers, splice cages, sewer lines, pipeline markers, cable markers, valve box covers, clean-outs/traps, sprinkler systems, steam lines (including insulated tanks that may indicate steam lines), and cathodic protection on lines/tanks
- Observe paving scars (i.e., fresh asphalt/concrete patches, scored asphalt/concrete).

NOTE: In many cases, the onsite location of low-voltage electrical lines and individual property water and sewer line branches may be approximated by using the following technique:

- Locate the entry/connection location at the facility building

- Attempt to identify utility connections for the mains (water sewer, etc.) by locating clean-outs, valve manways, etc. The location path of the utility is likely with the area between the main connection and facility building connection. Subsurface electrical line locations from the facility building to signs, lamps, etc. can be estimated with the same process.

2.2.6 Other Subsurface Systems

Some other subsurface systems to be cognizant of during subsurface activities include product delivery systems (i.e., at gas stations) and existing remediation systems.

2.2.7 Selection of Ground Disturbance Locations

EA will utilize the information collected to this point in combination with regulatory requirements and project objectives to select ground disturbance locations. Ground disturbance locations should also consider the location of overhead obstructions (e.g., power lines). Work at active gasoline retail locations must consider several special considerations that should be outlined in the site-specific safety and health plan.

2.2.8 Review of Selected Locations with the Client

EA will review the selected ground disturbance locations with the client. EA will not proceed with the subsurface activities until the plan has been discussed with the client. During execution of the project, subsurface activities are required outside of the area previously approved by the client. EA will submit these changes to the client for approval prior to execution.

2.2.9 Ground Disturbance Activity Sequence

EA will plan ground disturbance activities starting at the point farthest from the location of suspected underground improvements. This is done to determine the natural subsurface conditions and to allow EA site personnel to recognize fill conditions.

Experience has shown that the following warning signs may indicate the presence of a subsurface structure:

- Warning tape (typically indicative of underground services).

- Pea gravel/sand/non-indigenous material (typically indicative of tanks or lines).

- Red concrete (typically indicative of electrical duct banks).

- The abrupt absence of soil recovery in a hand auger. This could indicate pea gravel or sand that has spilled out of the auger. This may not be indicative in areas where native soil conditions typically result in poor hand auger recoveries.

- Any unexpected departure from the native soil or backfill conditions as established by prior onsite digging.

If any of these conditions is encountered by EA site personnel, digging should stop and the client should be contacted.

3. SUBSURFACE CLEARANCE METHODS

The method used to delineate the subsurface should be compatible with the inherent associated risk given the type of facility/property, soil stratigraphy, and the location of the ground disturbance activity, such that required delineation is obtained. It should be noted that in areas where there is paving, sufficient paving should be removed to allow clear visibility of the subsurface conditions during clearance activities. The following is a list of potential clearance methods that may be used on a job site:

- Vacuum digging
- Probing
- Hand digging
- Hand augering
- Post-hole digging.

EA personnel will evaluate the potential for electrical shock or fire/explosion for each subsurface disturbance project and will evaluate as necessary the use of non-conductive or non-sparking tools (i.e., fiberglass hand shovels, and thick electrically insulating rubber grips on hand augers or probes). The potential need for the use of non-conductive materials, electrical safety insulated gloves, and footwear will also be evaluated on a case-by-case basis.

3.1 SUBSURFACE CLEARANCE PROCEDURES FOR DRILLING, DIRECT-PUSH TECHNOLGY, AUGERING, FENCE POST INSTALLATION, OR OTHER BOREHOLE INSTALLATION ACTIVITIES

The area to be delineated will exceed the diameter of the largest tool to be advanced and sufficiently allow for visual inspection of any obstructions encountered.

3.2 SUBSURFACE CLEARANCE PROCEDURES FOR TRENCHING/ EXCAVATION ACTIVITIES

Appropriate subsurface clearance methods should be conducted along the length and width of the excavation at a frequency sufficient to ensure adequate precautions have been applied to the entire work area. The frequency and density of investigations will be based on site knowledge, potential hazards, and risks of the work area to surrounding locations (e.g., proximity to a residential area or school).

Whenever subsurface structures are exposed, EA will cease work and mark the area (e.g., flags, stakes, cross bracing) to ensure the integrity of these exposed structures is maintained during subsequent trenching/excavation/backfilling.

Uniform color codes for marking of underground facilities are provided in Appendix B.

Appendix A

Subsurface Clearance Procedure Checklist

Subsurface Clearance Procedure Checklist

Site Identification: ______________________________

Project Consultant/Contractor: ______________________________

Section 1: Safety, Preparation Tasks, and Mark-Outs

Activity	Yes	No	N/A	Comments including Justification if Response Is No or Not Applicable
Health and Safety Plan is available and all contractors and subcontractors are familiar with it.				
All applicable local, state, and federal permits have been obtained.				
Site access/permission has been secured.				
Most recent as-built drawings and/or site plans (including underground storage tank, product, and vent lines) obtained.				
Reviewed site information to identify subsurface structures relevant to planned site activities (easements, rights-of-way, historical plot plans, fire insurance plans, tank dip charts, previous site investigations, soil surveys, boring logs, aerial photographs, etc.).				
Utility mark-outs have been performed by public utility company(s). Mark-outs clear/visible.				
Subsurface structure mark-outs performed by private mark-out company. Mark-outs clear/visible.				
Additional Activities: Were dig locations reviewed with site representative?				

Section 2: Initial Site Visit and Selecting Ground Disturbance Locations

Activity	Yes	No	N/A	Comments including Justification if Response Is No or Not Applicable
Location of all aboveground indicators of subsurface utilities/services that may be leading to or from buildings within the planned work area has been identified.				
Location of utility mark-outs by all utility companies previously contacted has been identified within required time period.				
Location of all subsurface structure mark-outs by private mark-out company has been identified within required time period.				
Location of area lights/signs and associated subsurface lines identified.				
Location of all phones and associated subsurface lines identified.				
Location of all drains and associated interconnecting lines identified.				
Location of all electrical junction boxes and associated interconnecting lines identified				
Location of all natural gas meters or connections and all interconnecting lines identified				

Completed by: ______________________________
Name

Signature: ______________________________ ____________
Company Date

Appendix B

Uniform Color Codes for Excavation

APWA UNIFORM COLOR CODE

WHITE - Proposed Excavation

PINK - Temporary Survey Markings

RED - Electric Power Lines, Cables, Conduit and Lighting Cables

YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials

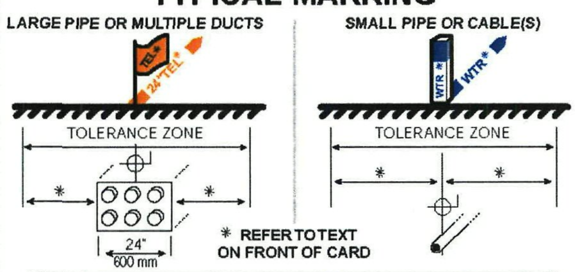
ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit

BLUE - Potable Water

PURPLE - Reclaimed Water, Irrigation and Slurry Lines

GREEN - Sewers and Drain Lines

TYPICAL MARKING



Customize with your center's phone and address information

GUIDELINES FOR UNIFORM TEMPORARY MARKING OF UNDERGROUND FACILITIES

This marking guide provides for universal use and understanding of the temporary marking of subsurface facilities to prevent accidents and damage or service interruption by contractors, excavators, utility companies, municipalities or any others working on or near underground facilities.

ONE-CALL SYSTEMS
The One-Call damage prevention system shall be contacted prior to excavation.

PROPOSED EXCAVATION
Use white marks to show the location, route or boundary of proposed excavation. Surface marks on roadways do not exceed 1.5" by 18" (40 mm by 450 mm). The facility color and facility owner identity may be added to white flags or stakes.

USE OF TEMPORARY MARKING
Use color-coded surface marks (i.e., paint or chalk) to indicate the location or route of active and out-of-service buried lines. To increase visibility, color coded vertical markers (i.e., stakes or flags) should supplement surface marks. Marks and markers indicate the name, initials or logo of the company that owns or operates the line, and width of the facility if it is greater than 2" (50 mm). Marks placed by other than line owner/operator or its agent indicate the identity of the designating firm. Multiple lines in joint trench are marked in tandem. If the surface over the buried line is to be removed, supplementary offset markings are used. Offset markings are on a uniform alignment and clearly indicate the actual facility is a specific distance away.

TOLERANCE ZONE
Any excavation within the tolerance zone is performed with non-powered hand tools or non-invasive method until the marked facility is exposed. The width of the tolerance zone may be specified in law or code. If not, a tolerance zone including the width of the facility plus 18" (450 mm) measured horizontally from each side of the facility is recommended.

ADOPT UNIFORM COLOR CODE
The American Public Works Association encourages public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation to adopt the APWA Uniform Color Code, using ANSI standard Z535.1 Safety Colors for temporary marking and facility identification.

Rev. 4/99

Standard Operating Procedure No. 004
for
Sample Packing and Shipping

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
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Revision 0
August 2007

CONTENTS

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to delineate protocols for the packing and shipping of samples to the laboratory for analysis.

2. MATERIALS

The following materials may be required:

Clear tape	Plastic garbage bags
Custody seals	Sample documentation
Ice	Waterproof coolers (hard plastic or metal)
Metal cans with friction-seal lids (e.g., paint cans)	Zip-seal plastic bags
Packing material[1]	

3. PROCEDURE

Check cap tightness and verify that clear tape covers label and encircles container. Wrap sample container in bubble wrap or closed cell foam sheets. Enclose each sample in a clear zip-seal plastic bag.

Place several layers of bubble wrap, or at least 1 in. of vermiculite on the bottom of the cooler. Line cooler with open garbage bag, place all the samples upright inside a garbage bag, and tie the bag.

Double bag and seal loose ice to prevent melting ice from soaking the packing material. Place the ice outside the garbage bags containing the samples.

Pack shipping containers with packing material (closed-cell foam, vermiculite, or bubble wrap). Place this packing material around the sample bottles or metal cans to avoid breakage during shipment.

Enclose all sample documentation (i.e., Field Parameter Forms, chain-of-custodies) in a waterproof plastic bag and tape the bag to the underside of the cooler lid. If more than one cooler is being used, each cooler will have its own documentation.

Seal the coolers with signed and dated custody seals so that if the cooler were opened, the custody seal would be broken. Place clear tape over the custody seal to prevent damage to the seal.

1. Permissible packing materials are: (a) (non-absorbent) bubble wrap or closed cell foam packing sheets, or (b) (absorbent) vermiculite. Organic materials such as paper, wood shavings (excelsior), and cornstarch packing "peanuts" will not be used.

Refer to SOP Nos. 001, 002, 016, and 039.

Tape the cooler shut with packing tape over the hinges and place tape over the cooler drain. Ship all samples via overnight delivery on the same day they are collected if possible.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

Any samples suspected to be of medium/high contaminant concentration or containing dioxin must be enclosed in a metal can with a clipped or sealable lid (e.g., similar to a paint can). Label the outer metal container with the sample number of the sample inside.

6. REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80.

U.S. EPA. 1990. Sampler's Guide to the Contract Laboratory Program. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C. December.

U.S. EPA. 1991. User's Guide to the Contract Laboratory Program. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response. January.

Standard Operating Procedure No. 005
for
Field Decontamination

Prepared by

EA Engineering, Science, and Technology, Inc.
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August 2007

CONTENTS

1. SCOPE AND APPLICATION

All personnel or equipment involved in intrusive sampling, or which enter a hazardous waste site during intrusive sampling, must be thoroughly decontaminated prior to leaving the site to minimize the spread of contamination and prevent adverse health effects. This Standard Operating Procedure describes the normal decontamination of sampling equipment and site personnel.

2. MATERIALS

The following materials may be required:

0.01N HCl	Non-phosphate laboratory detergent (liquinox)
0.10N nitric acid	Plastic garbage bags
Aluminum foil or clean plastic sheeting	Plastic sheeting, buckets, etc. to collect wash water and rinsates
Approved water	Pressure sprayer, rinse bottles, brushes
High performance liquid chromatography (HPLC)-grade water[1]	Reagent grade alcohol[2]

3. PROCEDURE

3.1 SAMPLE BOTTLES

At the completion of each sampling activity, the exterior surfaces of the sample bottles must be decontaminated as follows:

- Ensure the bottle lids are on tight.
- Wipe the outside of the bottle with a paper towel to remove gross contamination.

3.2 PERSONNEL DECONTAMINATION

Review the project Health and Safety Plan for the appropriate decontamination procedures.

1. For the purposes of this Standard Operating Procedure, HPLC-grade water is considered equivalent to "deionized ultra filtered water," "reagent-grade distilled water," and "deionized organic-free water." The end product being water which is pure with no spurious ions or organics to contaminate the sample. The method of generation is left to the individual contractor.
2. For the purposes of this Standard Operating Procedure, the term "reagent grade alcohol" refers to either pesticide grade isopropanol or reagent grade methanol.

3.3 EQUIPMENT DECONTAMINATION

3.3.1 Water Samplers

3.3.1.1 Bailers

After each use, polytetrafluoroethelyne (PTFE) double check valve bailers used for groundwater sampling will be decontaminated as follows:

- Discard all ropes used in sampling in properly marked sealable container, or as directed by the Health and Safety Plan. NOTE: No tubing is to be used in conjunction with a bailer in collecting samples.
- Scrub the bailer to remove gross (visible) contamination, using appropriate brush(es), approved water, and non-phosphate detergent.
- Rinse off detergent three times with approved water.
- Rinse bailer with reagent grade alcohol.
- Rinse bailer three times with HPLC-grade water.
- Rinse bailer with 0.10N nitric acid solution.
- Rinse bailer three times with HPLC-grade water.
- Allow bailer to air dry.[3]
- Wrap bailer in aluminum foil or clean plastic sheeting, or store in a clean, dedicated polyvinyl chloride or PTFE storage container.
- Dispose of used decontamination solutions with drummed purge water.
- Rinse bailer with HPLC-grade water immediately prior to re-use.

3.3.1.2 Pumps

Submersible pumps will be decontaminated as follows:

3. If the bailer has just been used for purging and is being decontaminated prior to sampling, do not air dry. Double rinse with HPLC-grade water and proceed to collect samples.

- Scrub the exterior of the pump to remove gross (visible) contamination, using appropriate brush(es), approved water, and non-phosphate detergent. (Steam cleaning may be substituted for detergent scrub.)

- Calculate the volume of pump plus any tubing which is not disposable and not dedicated to a single well. Pump three volumes of non-phosphate laboratory detergent solution to purge and clean the interior of the pump.

- Rinse by pumping no less than nine volumes of approved water to rinse.

- Rinse pump exterior with reagent grade alcohol.

- Rinse pump exterior with HPLC-grade water.

- Allow pump to air dry.

- Wrap pump in aluminum foil or clean plastic sheeting, or store in a clean, dedicated polyvinyl chloride or PTFE storage container.

- Prior to reusing pump rinse exterior again with HPLC-grade water. (Double rinse in Bullet 5 above may be substituted for this step).

3.3.1.3 Dip Samplers

All dip samplers, whether bucket, long-handled, or short-handled, will be decontaminated in the same manner as provided in Section 3.3.1.1.

3.3.1.4 Labware

Labware, such as beakers, which are used to hold samples for field measurements, water chemistry, etc. will be decontaminated according to the procedures in Section 3.3.1.1.

3.3.1.5 Water Level Indicators

Electric water level indicators, weighted measuring tapes, or piezometers used in the determination of water levels, well depths, and/or non-aqueous phase liquid levels will be decontaminated in accordance with Section 3.3.1.1. Clean laboratory wipes may be substituted for brushes. Tapes, probes, and piezometers should be wiped dry with clean laboratory wipes, and coiled on spools or clean plastic sheeting rather than allowed to air dry.

3.3.2 Solid Materials Samplers

Solid materials samplers include soil sampling probes, augers, trowels, shovels, sludge samplers, and sediment samplers, which will be decontaminated as follows:

- Scrub the sampler to remove gross (visible) contamination, using appropriate brush(es), approved water, and non-phosphate laboratory detergent.
- Rinse off detergent with approved water.
- Rinse sampler with reagent grade alcohol.
- Rinse sampler with HPLC-grade water.
- For non-metallic samplers only, rinse sampler with 0.10N nitric acid solution.
- For non-metallic samplers only, rinse sampler with HPLC-grade water.
- Allow sampler to air dry.
- Wrap sampler in aluminum foil clean plastic sheeting, or store in a new zipseal bag (size permitting) or clean, dedicated polyvinyl chloride or PTFE storage container.
- Dispose used decontamination solutions properly according to the site-specific Health and Safety Plan.
- Rinse sampler with HPLC-grade water immediately prior to re-use.

3.3.3 Other Sampling and Measurement Probes

Soil gas sampling probes will be decontaminated as solids sampling devices.

Temperature, pH, conductivity, redox, and dissolved oxygen probes will be decontaminated according to manufacturer's specifications. If no such specifications exist, remove gross contaminant and triple rinse probe with HPLC-grade water. A summary of the decontamination procedures to be used must be included in the instrument-specific standard operating procedure.

Measuring tapes that become contaminated through contact with soil during field use will be decontaminated as follows:

- Wipe tape with a clean cloth or laboratory wipe that has been soaked with non-phosphate laboratory detergent solution to remove gross contamination. Rinse cloth in the solution and continue wiping until tape is clean.
- Wipe tape with a second clean, wet cloth (or laboratory wipe) to remove soap residues.
- Dry tape with a third cloth (or laboratory wipe) and rewind into case, or re-coil tape.

3.3.4 Drilling Rigs and Other Heavy Equipment

All drilling rigs and associated equipment such as augers, drill casing, rods, samplers, tools, recirculation tank, and water tank (inside and out) will be decontaminated prior to site entry after over-the-road mobilization and immediately upon departure from a site after drilling a hole. Supplementary cleaning will be performed prior to site entry when there is a likelihood that contamination has accumulated on tires and as spatter or dust enroute from one site to the next.

- Place contaminated equipment in an enclosure designed to contain all decontamination residues (water, sludge, etc.).
- Steam clean equipment until all dirt, mud, grease, asphaltic, bituminous, or other encrusting coating materials (with the exception of manufacturer-applied paint) have been removed.
- Water used will be taken from an approved source.
- Containerize in 55-gal drums; sample; characterize; and, based on sample results, dispose of all decontamination residues properly.

Other heavy equipment includes use of backhoes, excavators, skid steers, etc. If heavy equipment is utilized during field activities, i.e., a backhoe for test pitting, the bucket should not come in contact with soil to be sampled. If the bucket contacts the soil to be sampled, then it should be decontaminated between sample locations, following the same procedures as listed above for a drill rig.

3.3.5 High Performance Liquid Chromatography-Grade Water Storage

Dedicated glass storage containers will be used solely for dispensing HPLC-grade water. New HPLC-grade water containers will be decontaminated as follows:

- Clean with tap water from approved source and non-phosphate laboratory detergent while scrubbing the exterior and interior of the container with a stiff-bristled brush.
- Rinse thoroughly with approved water.
- Rinse with 0.01N nitric acid.
- Rinse with approved water.
- Rinse thoroughly with HPLC-grade water.
- Fill clean container with HPLC-grade water. Cap with one layer of PTFE-lined paper and one layer of aluminum foil. Secure cap with rubber band and date the container.

Used HPLC-grade water containers will be decontaminated as follows:

- Clean the exterior with tap water from an approved source, non-phosphate laboratory detergent, and a stiff-bristled brush.
- Rinse the exterior thoroughly with HPLC-grade water.
- Rinse the interior twice with pesticide-grade isopropanol.
- Rinse interior thoroughly with HPLC-grade water.
- Fill clean container with HPLC-grade water. Cap with one layer of PTFE-lined paper and one layer of aluminum foil. Secure cap with rubber band and date the container.

3.3.6 Ice Chests and Reusable Shipping Containers

- Scrub exterior/interior with approved brush and liquinox detergent.
- Rinse off detergent three times with approved water.
- Let air dry and properly store until re-use.

NOTE: If container/ice chest is severely contaminated, clean as thoroughly as possible, render unusable, and properly dispose.

4. MAINTENANCE

HPLC-grade water will be stored only in decontaminated glass containers with aluminum foil lids as stipulated above. The water may not be stored for more than nor used more than 3 days after manufacture.

HPLC-grade water will be manufactured onsite. An approved tap water source will be used as the influent to the system. Procedures for system setup, operation, and maintenance will conform to manufacturer's specifications.

5. PRECAUTIONS

Dispose of all wash water, rinse water, rinsates, and other sampling wastes (tubing, plastic sheeting, etc.) in properly marked, sealable containers, or as directed by the Health and Safety Plan.

Once a piece of equipment has been decontaminated, be careful to keep it in such condition until needed.

Do not eat, smoke, or drink onsite.

6. REFERENCES

Site-specific Health and Safety Plan.

Standard Operating Procedure No. 015
for
Document Control System

Prepared by

EA Engineering, Science, and Technology, Inc.
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August 2007

CONTENTS

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to delineate protocols for identifying and storing a complete set of documents relating to project tasks. Each document will receive a unique identification number comprised of elements describing the document.

2. MATERIALS

Not applicable.

3. PROCEDURE

Each project-related document will be given to the Document Control Officer. The Document Control Officer will record information for each document on a Document Control Sheet which will be retained as a backup record. The information from each Document Control Sheet will be maintained in a computer database.

The individual Document Control Number will be entered on the Document Log Sheet and will be written on the document.

The storage location for each document will be recorded on the Document Control Log Sheet and the documents will be stored in the recorded location.

The database file will be backed up on a regular basis to prevent accidental loss of the data.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

None.

6. REFERENCES

None.

Standard Operating Procedure No. 021
for
Sediment Sampling

Prepared by

EA Engineering, Science, and Technology, Inc.
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CONTENTS

1. SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) delineates protocols for sampling sediments from streams, rivers, ditches, lakes, ponds, lagoons, and marine and estuarine systems.

EA recognizes that other protocols have been developed that meet the criteria of quality and reproducibility. Clients may have their own sediment sampling protocols which may contain methodologies and procedures that address unique or unusual site-specific conditions or may be in response to local regulatory agency requirements. In such cases, EA will compare its and the client's protocols. The goal is to provide the client with the most quality; therefore, if the client's protocols provide as much or more quality assurance than EA's protocols for the particular site or project, EA will adopt those particular protocols and this SOP will be superseded in those respects. If EA is required to implement the client's protocols in lieu of EA's protocols, EA will make the client formally aware of any concerns regarding differences in protocols that might affect data quality and will document such concerns in the project file.

2. PROCEDURES

The water content of sediment varies. Sediments range from soft to dense and fine to rocky. A variety of equipment may be necessary to obtain representative samples, even at a single site. Factors to consider in selecting the appropriate sampling equipment include sample location (edge or middle of the waterbody), depth of water and sediment, grain size, water velocity, and analytes of interest.

3. GENERAL PROCEDURES

1. Surface water and sediment samples are to be collected at the same location (if both are required in the project-specific Sampling and Analysis Plan).

2. Collect the surface water sample first. Sediment sampling usually results in disturbance of the sediments, which may influence the analytical results of the surface water samples.

3. Wear gloves when collecting samples. Comply with the Health and Safety Plan specifications for proper personal protective equipment.

4. If sampling from a boat or near waterbodies with depths of 4 ft or more, the sampling team will wear life jackets.

5. Wading into a waterbody disturbs the sediment. Move slowly and cautiously, approach the sample location from downstream. If flow is not strong enough to move entrained particles away from the sample location, wait for the sediment to resettle before sampling.

6. Collect samples first from areas suspected of being the least contaminated, thus minimizing the risk of cross-contamination.

7. Collecting samples directly into sample containers is not recommended. Sediment samples should be placed in Teflon®, stainless steel, or glass trays, pans, or bowls for sample preparation.

8. Use the proper equipment and material construction for the analytes of interest. For example, for volatile organic compound analysis, the sampling material in direct contact with the sediment or surface water must consist of Teflon, polyethylene, or stainless steel.

9. Refer to EA SOP No. 005 (Field Decontamination) for proper decontamination methods before and after sampling and between samples.

10. Collect samples for volatile organic compound analysis first. Do not mix such samples before placing them in the sample containers. For composite volatile organic compound samples, place equal aliquots of each subsample in the sample container.

11. Sediment that will be analyzed for other than volatile organic compounds should be prepared as follows:

    - Place the sediment in a mixing container.
    - Divide the sediment into quarters.
    - Mix each quarter separately and thoroughly.
    - Combine the quarters and mix thoroughly.
    - For composite samples, mix each subsample as described above. Place equal aliquots of each subsample in a mixing container and follow the procedure described above.

12. Mark the sampling location on a site map. Record sampling location coordinates with a Global Positioning System unit, photograph (optional, recommended) and describe each location, and place a numbered stake above the visible high water mark on the bank closest to the sampling location. The photographs and description must be adequate to allow the sampling station to be relocated at a future date.

13. Dispose of investigation-derived wastes according to applicable rules and regulations.

4. CORERS

A corer provides a vertical profile of the sediment, which may be useful in tracing historical contaminant trends. Because displacement is minimal, a corer is particularly useful when sampling for trace metals and organics. Corers can be constructed out of a variety of materials.

For example, a 2-in. diameter polyvinyl chloride pipe with a Teflon or polyethylene liner can be lowered into the sediment; a 2-in. diameter well cap can be used to form an airtight seal and negative pressure as the pipe is withdrawn.

- Ensure that the corer and (optional) liner are properly cleaned.
- Stand downstream of the sample location.
- Force the corer into the sediment with a smooth continuous motion. Rotate (not rock) the corer if necessary to penetrate the sediment.
- Twist the corer to detach the sample; then withdraw the corer in a single smooth motion. If the corer does not have a nosepiece, place a cap on the bottom to keep the sediment in place.
- Remove the top of the corer and decant the water (into appropriate sample containers for surface water analysis, if required).
- Remove the nosepiece or cap and deposit the sample into a stainless steel, Teflon, or glass tray.
- Transfer the sample into sample containers using a stainless steel spoon (or equivalent device).

5. SCOOPS AND SPOONS

When sampling at the margins of a waterbody or in shallow water, scoops and spoons may be the most appropriate sampling equipment. For collecting samples several feet from shore or in deeper water, the scoop or spoon may be attached to a pole or conduit.

- Stand downstream of the sample location.
- Collect the sample slowly and gradually to minimize disturbing the fine particles.
- Decant the water slowly to minimize loss of fine particles.
- Transfer the sediment to sample containers or mixing trays, as appropriate.

6. DREDGES

Three types of dredges are most frequently used: Peterson, Ponar, and Eckman. Many other dredge types are available; their applicability will depend upon site-specific factors.

6.1 PETERSON AND PONAR DREDGES

These dredges are suitable for hard, rocky substrates, deep waterbodies, and streams with fast currents. Ponars have top screens and side plates to prevent sample loss during retrieval.

- Open the jaws and place the cross bar into the proper notch.
- Lower the dredge to the bottom, making sure it settles flat.
- When tension is removed from the line, the cross bar will drop, enabling the dredge to close as the line is pulled upward during retrieval.
- Pull the dredge to the surface. Make sure the jaws are closed and that no sample was lost during retrieval.
- Open the jaws and transfer the sediment to sample containers or to a mixing tray.

6.2 ECKMAN DREDGE

The Eckman dredge works best in soft substrates in waterbodies with slow or no flow.

- Open the spring-loaded jaws and attach the chains to the pegs at the top of the sampler.
- Lower the dredge to the bottom, making sure it settles flat.
- Holding the line taut, send down the message to close the jaws.
- Pull the dredge to the surface. Make sure the jaws are closed and that no sample was lost during retrieval.
- Open the jaws and transfer the sediment to sample containers or a mixing tray.

7. REFERENCES

None.

Standard Operating Procedure No. 025
for
Soil Sampling

Prepared by

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CONTENTS

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to delineate protocols for sampling surface and subsurface soils. Soil samples give an indication of the area and depth of site contamination, so a representative sample is very important.

2. MATERIALS

The following materials may be required:

Bucket auger or push tube sampler	Split-spoon, Shelby tube, or core barrel sampler
Drill rig and associated equipment	Stainless steel bowl
Personal protective equipment as required by the Health and Safety Plan	Stainless steel spoon, trowel, knife, spatula (as needed)

3. PROCEDURE

3.1 SUBSURFACE SAMPLES

Don personal protective equipment. Collect split-spoon, core barrel, or Shelby Tube samples during drilling. Upon opening sampler, or extruding sample, immediately screen soil for volatile organic compounds using either a photoionization detector or flame ionization detector. If sampling for volatile organic compounds, determining the area of highest concentration, use a stainless steel knife, trowel, or laboratory spatula to peel and sample this area. Log the sample in the Field Logbook while it is still in the sampler. Peel and transfer the remaining sample in a decontaminated stainless steel bowl. Mix thoroughly with a decontaminated stainless steel spoon or trowel. Place the sample into the required number of sample jars. Preserve samples as required. Discard any remaining sample into the drums being used for collection of cuttings. Decon sampling implements. All borings will be abandoned.

NOTE: If sample recoveries are poor, it may be necessary to composite samples before placing them in jars. In this case, the procedure will be the same, except that two split-spoon samples will be mixed together. The Field Logbook should clearly state that the samples have been composited, which samples were composited, and why the compositing was done.

Samples taken for geotechnical analysis will be undisturbed samples, collected using a thin-walled (Shelby tube) sampler.

3.2 SURFICIAL SOIL SAMPLES

Don personal protective equipment. Remove vegetative mat. Collect a sample from under the vegetative mat with a stainless steel trowel, push tube sampler, or bucket auger. If a representative sample is desired over the depth of a shallow hole or if several shallow samples are to be taken to represent an area, composite as follows:

- As each sample is collected, place a standard volume in a stainless steel bowl.
- After all samples from each hole or area are in the bucket, homogenize the sample thoroughly with a decontaminated stainless steel spoon or spatula.

If no compositing is to occur, place sample directly into the sample jars. Place the leftover soil in the auger borings and holes left by sampling. If necessary, add clean sand to bring the subsampling areas back to original grade. Replace the vegetative mat over the disturbed areas. Samples for volatile organic compounds will not be composited. A separate sample will be taken from a central location of the area being composited and transferred directly from the sampler to the sample container. Preserve samples as required. Decon sampling implements.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

Refer to the Health and Safety Plan.

Soil samples will not include vegetative matter, rocks, or pebbles, unless the latter are part of the overall soil matrix.

6. REFERENCES

American Society for Testing and Materials (ASTM). Method D1586-84, Penetration Test and Split-Barrel Sampling of Soils.

ASTM. Method D1587-83, Thin Walled Sampling of Soils.

Department of the Army, Office of the Chief of Engineers. 1972. Engineer Manual 1110-2-1907 Soil Sampling. 31 March.

Standard Operating Procedure No. 028
for
Well and Boring Abandonment

Prepared by

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CONTENTS

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to establish the protocols by which all wells and borings will be safely abandoned. The primary objective of well abandonment is to ensure that the abandoned well or boring does not provide a conduit for the vertical migration of contamination between aquifers.

2. MATERIALS

The following materials may be required:

Drill rig	Bentonite pellets (seal)
Filter pack material	Cement (Portland Type II)
Pure sodium bentonite with no additives (bentonite) powder (grout)	Approved water

3. PROCEDURE

The procedures used in boring abandonment will ideally accomplish two objectives: (1) protect aquifers from cross-contamination by sealing the borehole, and (2) restore the strata in the borehole to nearly original conditions by selective placement of fill material.

Any casing will be pulled, drilled out, or thoroughly pierced. Using tremie pipe, grout will be placed from the bottom of the hole to within 3 ft of the ground surface, and allowed to settle for 24 hours. The remainder of the hole will be filled with concrete. The surface of the concrete will be mounded, smoothed, and inscribed with "ABD," for abandoned, any assigned well or boring designation, and the date the hole was abandoned. All boring logs, samples, completion records, and abandonment procedures will be included in the records of work on the site or cluster.

If the hole is within 10 ft of a monitoring well in the same aquifer, or a replacement well is to be installed within 10 ft of the well, any temporary casing will be pulled, drilled out, or thoroughly pierced. Using tremie pipe, the hole will then be backfilled with filter pack material opposite sand strata and bentonite or grout opposite substantial (2 ft or thicker) clay and silt strata. Where sand as backfill approaches the ground surface, 2 ft of bentonite will be placed above the sand and a 3-ft concrete plug will be placed at the surface. Otherwise, backfill materials will be placed from the bottom of the hole to within 3 ft of the ground surface. These materials will be allowed to settle for 24 hours. The remainder of the hole will be filled with concrete. The surface of the concrete will be mounded, smoothed, and inscribed with "ABD," for abandoned, any assigned well or boring designation, and the date the hole was abandoned. All boring logs, samples, completion records, and abandonment procedures will be included in the records of work on the site cluster.

If the well is not within 10 ft of another monitoring well, or if there are no substantial, continuous sand bodies, and no replacement well is planned within 10 ft of the original well location, then the hole may be grouted from the bottom to the top.

3.1 GROUT

Grout used in construction will be composed by weight of:

- 20 parts cement (Portland cement, Type II or V)
- 0.4-1 part (maximum) (2-5 percent) bentonite
- 8 gal (maximum) approved water per 94-lb bag of cement.

Neither additives nor borehole cuttings will be mixed with the grout. Bentonite will be added after the required amount of cement is mixed with the water.

All grout material will be combined in an aboveground container and mechanically blended to produce a thick, lump-free mixture. The mixed grout will be recirculated through the grout pump prior to placement.

Grout placement will be performed using a commercially available grout pump and a rigid tremie pipe removal and grouting will be accomplished in stages, aquifer by aquifer, sealing the boring from the bottom to ground surface. This will be accomplished by placing a grout pipe to the bottom and pumping grout through the pipe until undiluted grout reaches the bottom of the next higher section of casing or, for the top-most section, until grout flows from the boring at ground surface. Efforts will be made to grout incrementally as the temporary casing is removed.

After 24 hours, the abandoned drilling site will be checked for grout settlement. On that day, any settlement depression will be filled with grout and rechecked 24 hours later. This process will be repeated until firm grout remains at the ground surface.

3.2 BORINGS

The term "Borings" as used in this Standard Operating Procedure applies to any drilled hole made during the course of a remedial investigation which is not completed as a well. This includes soil test borings, soil sampling borings, and deep stratigraphic borings. Whether completed to the planned depth or aborted for any reason prior to reaching that depth, borings will be grouted and normally closed within 4 hours, or within 4 hours or completion of logging of completion of logging.

3.2.1 Shallow Borings not Penetrating Water Table

Shallow borings made for the collection of subsurface soil samples will be abandoned by backfilling the hole with cuttings from the hole, **if and only if the boring does not penetrate the water table.** Clean sand will be used to make up any volume not filled by the cuttings.

3.2.2 Borings Penetrating the Water Table

Shallow borings made for the collection of subsurface soil samples **which penetrate the water table** will be abandoned by grouting the hole from the bottom to the top.

3.2.3 Deep Stratigraphic Borings

Deep stratigraphic borings will normally be located in areas which, by virtue of the historical record, are presumed relatively uncontaminated. Therefore, these borings are usually over 100 ft from any sampling well locations. Any boring located within 10 ft of a proposed well location, or located directly upgradient or downgradient (on anticipated flow line) of a proposed well location, will be abandoned by placing clean sand in the aquifer intervals and bentonite or grout in aquitard intervals as described above. If the boring is over 10 ft from and/or not upgradient of a proposed well location, the boring will be completely filled with grout.

3.3 WELLS

The following procedure applies to wells aborted prior to completion and existing wells determined to be ineffective or otherwise in need of closure.

Prior to abandoning any developed well, the proper well licensing body will be provided written notification along with an abandonment plan for that well.

If the well is within 10 ft of another monitoring well in the same aquifer, or a replacement well is to be installed within 10 ft of the well, casing will be pulled, drilled out, or thoroughly pierced. Using tremie pipe, the hole will then be backfilled with filter pack material opposite sand strata and bentonite or grout opposite substantial (2 ft or thicker) clay and silt strata. Where sand as backfill approaches the ground surface, 2 ft of bentonite will be placed above the sand and below the concrete plug near the surface. Backfill materials will be placed from the bottom of the hole to within 3 ft of the ground surface. These materials will be allowed to settle for 24 hours. The remainder of the hole will be filled with concrete. The surface of the concrete will be mounded, smoothed, and inscribed with "ABD," for abandoned, any assigned well or boring designation, and the date the hole was abandoned. All boring logs, samples, completion records, and abandonment procedures will be included in the records of work on the site cluster.

If the well is not within 10 ft of another monitoring well, and is not to be replaced by another well within 10 ft of the original location, casing will be pulled, drilled out, or thoroughly pierced. Using tremie pipe, grout will be placed from the bottom of the hole to within 3 ft of the ground surface, and allowed to settle for 24 hours. The remainder of the hole will be filled with concrete. The surface of the concrete will be mounded, smoothed, and inscribed with "ABD," for abandoned, any assigned well or boring designation, and the date the hole was abandoned. All boring logs, samples, completion records, and abandonment procedures will be included in the records of work on the site cluster.

4. REPLACEMENT WELLS

Replacement wells (if any) will normally be offset at least 10 ft from any abandoned well in a presumed upgradient or crossgradient groundwater direction. Site-specific conditions may necessitate variation to this placement.

5. PRECAUTIONS

None.

Standard Operating Procedure No. 039 for Sample Preservation and Container Requirements

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
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CONTENTS

1. PURPOSE AND SCOPE

The purpose of this Standard Operating Procedure (SOP) is to define the preservatives and techniques to be employed in preserving environmental samples between collection and analysis.

2. MATERIALS

The following materials may be required:

Containers (see Section 3 for description)	NaOH
HNO_3	Ice chests
H_2SO_4	Ice

3. DEFINITION OF CONTAINER TYPES

Type A
Container: 80 oz amber glass, ring handle bottle/jug, 38-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 38-430 size, 0.015-mm polytetrafluoroethelyne (PTFE) liner.

Type B
Container: 40-mL glass vial, 24-mm neck finish
Closure: White polypropylene or black phenolic, open top, screw cap, 15-mm opening, 24-400 size.
Septum: 24-mm disc of 0.005-in PTFE bonded to 0.120-in. silicon for total thickness of 0.125-in.

Type C
Container: 1-L high density polyethylene, cylinder-round bottle, 28-mm neck finish.
Closure: White polyethylene cap, white ribbed, 28-410 size; F217 polyethylene liner.

Type D
Container: 120-mL wide mouth glass vial, 48-mm neck finish.
Closure: White polyethylene cap, 40-480 size; 0.015-mm PTFE liner.

Type E
Container: 250-mL boston round glass bottle
Closure: White polypropylene or black phenolic, open top, screw cap.
Septum: Disc of 0.005-in PTFE bonded to 0.120-in silicon for total thickness of 0.125-in.

Type F **Container**: 8-oz short, wide mouth, straight-sided, flint glass jar, 70-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 48-400 size; 0.030-mm PTFE liner.

Type G **Container**: 4-oz tall, wide mouth, straight -sided, flint glass jar, 48-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 48-400 size; 0.015-mm PTFE liner.

Type H **Container**: 1-L amber, Boston round, glass bottle, 33-mm pour-out neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 33-430 size; 0.015-mm PTFE liner.

Type K **Container**: 4-L amber glass ring handle bottle/jug, 38-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 38-430 size; 0.015-mm PTFE liner.

Type L **Container**: 500-mL high-density polyethylene, cylinder bottle, 28-mm neck finish.
Closure: White polypropylene, white ribbed, 28-410 size; F217 polyethylene liner.

4. PROCEDURE

All containers must be certified clean, with copies of laboratory certification furnished upon request.

Water samples will be collected into pre-preserved containers appropriate to the intended analyte as given in Quality Assurance Project Plan. Samples taken for volatile organic compounds will be collected in accordance with SOP No. 003, Section 3.3.8. Samples taken for metals analysis will be verified in the field to a pH <2. The container should be tightly capped, then swirled to thoroughly mix the sample. The cap will then be loosened to release any excess pressure this operation may have generated. Samples taken for total phosphorous content will be verified in the field to a pH <2. The container should be tightly capped and swirled to thoroughly mix the sample. The cap will then be loosened to release any excess pressure this operation may have generated. Samples taken for cyanide will be verified for a pH >12. No preservatives will be added to any other water samples. These samples will be immediately placed on ice and cooled to 4°C.

Soil and sediment samples will be collected into containers appropriate to the intended analyte as given in the Quality Assurance Project Plan. Samples taken for volatile organic compound analysis will collected in accordance with the site-specific SOP. Samples taken for metals analysis will be tightly capped, placed on ice, and maintained at a temperature of 4°C. Samples taken for total phosphorous content will be tightly capped, placed on ice, and maintained at a temperature of 4°C. Samples taken for cyanide will be alkalized to a pH > 12 by the addition of NaOH. No preservatives will be added to any other soil samples. These samples will be immediately placed on ice and cooled to 4°C.

5. MAINTENANCE

Not applicable.

6. PRECAUTIONS

Note that acidifying a sample containing cyanide may liberate HCN gas.

- Avoid breathing any fumes emanating from acidified samples.
- Acidify samples only in the open, rather than in closed spaces such as a vehicle.
- Hold suspected HCN-generating sample away from body and downwind while manipulating it.
- See the Health and Safety Plan for other safety measures

7. REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 1986. Test Methods for Evaluating Solid Waste, SW-845.

U.S. EPA. 1987. A Compendium of Superfund Field Operations Methods, EPA 540-P87-001.

U.S. EPA. 1991. A Compendium of ERT Soil Sampling and Surface Geophysics Procedures.

Standard Operating Procedure No. 042
for
Disposal of
Investigation-Derived Material

Prepared by

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August 2007

CONTENTS

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to define the required steps for disposing of investigation-derived material (IDM) generated during field activities.

IDM, as used herein, includes soil cuttings, drilling muds, purged groundwater, decontamination fluids, and disposable personal protective equipment. For the sake of clarity and ease in use, this Standard Operating Procedure is subdivided into procedures for disposal of liquid IDM and solid IDM as follows:

- Liquid IDM (Section 3.2) includes the following materials:
  - — Water from initial development of new wells and the redevelopment of existing wells.
  - — Purge water from groundwater sampling.
  - — Decontamination fluids (Section 3.4)
- Solid IDM (Section 3.3) consists of the following materials:
  - — Drill cuttings from monitoring well installation
  - — Grout, a mixture of cement and bentonite, generated during installation of monitoring wells
  - — Disposable personal protective equipment (Section 3.4).

2. MATERIALS

The following materials may be required:

Any additional equipment that may be dictated by project or site-specific plans	Hazardous waste labels
Bar codes	Permanent marker
Chain-of-custody forms	Field Logbook (bound)
Department of Transportation 17C spec. metal containers	Waste identification labels

3. PROCEDURE

3.1 GENERAL

No container will be labeled as a "Hazardous Waste" unless the contents are in fact known to be hazardous as defined by 40 CFR 261.

IDM may be disposed onsite if it is: (1) initially screened, or evaluated to determine whether it is contaminated; (2) not abandoned in an environmentally unsound manner; and (3) not inherently waste-like.

IDM are to be considered contaminated if they: (1) are visually or grossly contaminated, (2) have activated any field monitoring device which indicates that the level exceeds standard Level 1,[1] (3) have previously been found to exhibit levels of contamination above environmental quality standards, and (4) the responsible party and/or appropriate regulator deem(s) that records of historical uses indicate that additional testing of the IDM is needed, or additional caution is warranted handling IDM from a given site.

3.2 PROCEDURES FOR LIQUID INVESTIGATION-DERIVED MATERIAL DISPOSAL

1. All water from initial development of new wells, and purge water generated during the first round of groundwater sampling will be containerized in Department of Transportation approved 55-gal drums. Decontamination fluids may be bulk-containerized until completion of field task.

2. Label all containers as to type of media, the date the container was sealed, the point-of-generation, and the points-of-contact. The well number and container number will be identified on the container.

3. The contractor/support personnel will log all media generated onsite into a bound Field Logbook. Media information should include the following: the date of generation, contents of containers, the number of containers with the same contents (if applicable), location of containers, the well number the media is associated with, personnel sampling the media, sampling dates, and sampling results.

4. Containers of well development water and purge water may be stored at the well site pending first round analytical results.

5. Laboratory turnaround time must be no greater than 30 days. Upon receipt of the analytical results, a copy will be furnished to the client within 3 working days. Both the client and contractor will evaluate the data to determine disposal requirements, per state and local regulations. A disposal decision is required within 10 days of receipt of sampling results. Appropriate disposal must be performed no later than 50 days from the decision date unless prevented by inclement weather (e.g., rain and muddy conditions may preclude site access, freezing weather may freeze media).

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1. This value is defined as two times background, where "background" values are to be determined as follows: (1) regional background values will be used where they are available; and (2) if regional values are not available, background may be empirically determined at uncontaminated sampling sites using onsite sensors such as organic vapor analyzers (photoionization detector or flame ionization detector), scintillometers, etc.

Dispose of non-hazardous media in accordance with Step 6 et seq. through 8 et seq. of this procedure.

Dispose of hazardous waste in accordance with Step 9 et seq. of this procedure.

6. If the first round analytical data of the liquid media is below the Maximum Contaminant Levels established by the Federal Safe Drinking Water Act, the water may be gradually infiltrated into the ground at least 50 ft downgradient of the well.

   If the well location has no downgradient area, the water will be infiltrated into the ground in an area deemed appropriate by the client and the contractor/support personnel.

   Disposal locations must allow percolation of the water and prohibit "ponding."

   Upon completion of water discharge to ground, enter type of media, amount of media, date of disposal, and discharge point(s) in a bound Field Logbook and provide this information to the client.

   Empty containers are to be properly decontaminated, stored, and reused by the appropriate personnel.

   If the liquid media sampling results do not meet the required Maximum Contaminant Levels and cannot be discharged to the ground, then determine if the waste meets the sanitary sewer discharge criteria (National Pollutant Discharge Elimination System standards).

7. If at any time visual contamination of purge/development water is observed, or if organic vapor monitor readings (HNu, photoionization detector) register more than 5 ppm above background and/or rad meters register more than twice the background mrems, then the liquid will be drummed and a composite sample will be taken that day. A disposal decision will be based on the analytical results of this sample rather than the first round of analytical results.

3.3 PROCEDURE FOR SOLID INVESTIGATION-DERIVED MATERIAL DISPOSAL

1. If the conditions outlined in Section 3.1 are met, proceed to Section 3.3, Step 2; otherwise, go to Section 3.3, Step 7.

2. During drilling operations, the resulting cuttings and mud will be discharged onto the ground near the well if the following conditions are met: (1) no visual contamination is observed, (2) organic vapors are less than 5 ppm above background, (3) rad meter readings (if applicable) are under two times background, and (4) if the potential for metals contamination exists, the medium has been screened and found to be less than two times background.

Proper sediment and erosion control measures will be implemented as follows:

- Drill cuttings will be uniformly spread and contoured to blend with the surroundings of the site.
- If amount of solid IDM exceeds 5,000 ft^2 or 100 yd^3 of material, a Sediment and Erosion Control Plan is required.
- If the amount of solid IDM is under 5,000 ft^2 or 100 yd^3, the site will be stabilized as soon as possible. Stabilization includes mulch, seed, and tack.
- Critical areas require stabilization within 7 days from the date of well completion. Critical areas include swales, water sources, drainage ditches, etc.
- All other disturbed areas require stabilization within 14 days from the date of well completion.

3. If the well location is in or near a wetland, the drill cuttings will be drummed and transported away from the site for spreading.

4. Label all IDM containers that will not be spread on the day of generation. Each container should be labeled with the type of media, the date the container was sealed, the point-of-generation, and the name of the contact person. The well number and container number should be identified on the container.

5. The contractor/support personnel will log all media generated onsite into a bound Field Logbook. Media information should include: the date of generation, contents in containers, the number of containers with the same contents, location of containers, and the well number the media is associated with.

6. Containers will be staged at the well site until contractor/support personnel spread the cuttings in the appropriate locations, using proper sediment and erosion control measures per Section 3.3 et seq.

7. If drilling mud and cuttings show visible contamination, or organic vapor readings are more than 5 ppm above background levels, or rad meter readings (if applicable) show greater than two times background levels, media will immediately be containerized, labeled appropriately (Section 3.2), and sampled on the same day.

8. The solid IDM should be sampled and appropriate Toxicity Characteristic Leaching Procedure analyses conducted prior to determining disposition. Laboratory turn-around time must be no greater than 30 days. Upon receipt of analytical results, a copy will be furnished to the client within 3 working days. The contractor will evaluate the data to determine disposal requirements within 10 days. Appropriate disposal must be performed no later than 50 days after the decision date if weather permits (Section 3.2).

- If the solid IDM are determined to be non-hazardous and uncontaminated, go to Section 3.3.

- If the solid IDM are determined to be non-hazardous but contaminated , go to Section 3.3.

- If the solid IDM are found to be hazardous wastes, go to Section 3.3.

9. If the solid IDM are not a hazardous waste **and** analytical data shows contaminant concentrations below the U.S. Environmental Protection Agency Region 3 (or applicable Region where work is being performed) Risk-Based Concentrations, contact the appropriate federal, state, or local agency for approval to discharge onto the ground near the site of generation.

   - Follow steps detailed in Section 3.3, Step 2 et seq. (above) pertaining to sediment and erosion control.

   - Upon completion of the solid IDM discharge to the ground, enter type of media, amount of media, date of disposal, and discharge point(s) in a bound Field Logbook. This information must be provided to the client.

   - Empty containers are to be properly decontaminated, stored and reused by appropriate personnel.

10. If the intrusive media is not a hazardous waste but analytical data shows concentrations above the screening criteria, dispose of the IDM according to state and local regulations.

    - Ensure that the waste containers are properly labeled as applicable in accordance with Section 3.3, Step 4.

    - Inform the client of the type and amount of waste, and the location of the waste.

    - When the waste is removed, enter the type of waste, amount of waste, date of pickup, and the destination of the waste in a bound Field Logbook. This information must be provided to the client.

3.4 PROCEDURES FOR DECONTAMINATION SOLUTION AND PERSONAL PROTECTIVE EQUIPMENT DISPOSAL

Decontamination solutions include catch water from steam-cleaning operations performed on large sampling equipment, drill rigs, and drums, as well as smaller quantities of soapy water and rinse solutions used in decontaminating field sampling equipment. At the completion of the field event, a composite sample of the decontamination solution will be taken. The decontamination solution will be treated as liquid IDM pending results (Section 3.2 et seq.).

Personal protective equipment will be containerized onsite, appropriately labeled, and disposed of in a designated trash receptacle.

4. MAINTENANCE

Not applicable.

5. REFERENCES

Environment Article Section 7-201(t).

U.S. Environmental Protection Agency. 1991. Management of Investigation-Derived Wastes during Site Inspections PB91-921331, OERR Directive 9345.3-02. Office of Emergency and Remedial Response U.S. Environmental Protection Agency, Washington, D.C. May.

Standard Operating Procedure No. 047
Direct-Push Technology Sampling

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CONTENTS

1. SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) establishes the protocol for using direct-push technology (DPT) in media sampling and performing subsurface characterization. This SOP includes the following DPT methods: Geoprobe®, Hydropunch®, Cone Penetrometer Testing (CPT), and Site Characterization and Analysis Penetrometer System (SCAPS).

2. MATERIALS

The following materials may be required:

Appropriately sized, all-terrain vehicle-skid-or track-mounted; DPT equipment; and supplies (i.e., hydraulic derrick and hammer assembly)	Personal protective equipment
Bentonite grout and clean sand for DPT hole abandonment	Phosphate-free, laboratory-grade detergent (e.g., Liquinox, Alconox, etc.)
DPT stainless steel rods	Source of approved water
Heavy plastic sheeting	Steam cleaner/sprayer and water obtained from approved source for decontaminating DPT equipment
Logbook	Steel drums for intrusion derived wastes (e.g., contaminated personal protective equipment, decon solutions, etc.)
Long-handled bristle brushes	Wash and rinse tubs
Mini-bailer or tubing and peristaltic pump (groundwater sampling only)	

3. GEOPROBE® AND HYDROPUNCH®

3.1 MATERIALS

Water sources for Geoprobe® and Hydropunch® activities, grouting, sealing, filter placement, well installation, and equipment decontamination must be approved by the Project Manager prior to arrival of the Geoprobe® and Hydropunch® equipment. Information required for the water source includes: water source, manufacturer/owner, address and telephone number, type of treatment and filtration prior to tap, time of access, cost per gallon (if applicable), dates and results associated with all available chemical analysis over the past 2 years, and the name and address of the analytical laboratory (if applicable).

Pure sodium bentonite with no additives will be the only additive allowed, and its use must be approved by the Project Manager prior to the arrival of the Geoprobe® and Hydropunch® equipment. The information required for evaluation includes: brand name, manufacturer, manufacturer's address and telephone number, product number, product description, and intended use for the product.

Portland Type II cement will be used for grout (refer to SOP No. 019).

3.2 GROUNDWATER – HYDRAULIC PUSHING AND SAMPLING

The objective of the selected DPT sampling technique is to allow grab samples to be taken at a selected site to facilitate aquifer characterization and analysis of potential contaminants. The analytical results from sampling can also be used to determine the placement of monitoring wells.

A site geologist will be present during all sampling and installation procedures, and will fully document all procedures and soil characteristics in the Field Logbook. Refer to SOP No. 003 (Field Logbook).

The site geologist will have on hand, at a minimum, a copy of the approved Health and Safety Plan, this SOP, the Field Investigation Work Plan, a hand lens (10X), a standard color chart, and a grain size chart.

Only solid vegetable shortening (e.g., Crisco®) without flavoring or additives may be used on downhole Geoprobe® and Hydropunch® equipment.

Surface runoff or other fluids will not be allowed to enter any DPT location or well during or after DPT activities.

The subcontractor will use the equipment specific guidelines for installation of the Geoprobe® DPT equipment. Probe rods will be forced into the ground by hydraulic means.

- Drive the sampler to the desired groundwater sampling interval. At the desired depth, insert extension rods down the inside diameter of the probe rods until the extension reaches the bottom of the screen. Remove the probe rods and sampler sheath while holding the screen in place.
- Collect the groundwater sample in the screen interval with a mini-bailer, peristaltic or vacuum pump, or other acceptable small diameter sampling device.
- The head of the rod may be equipped with a sensing device for characterization of soil properties or the contaminant content.

The subcontractor will use the equipment-specific guidelines for installation of the Hydropunch® equipment. Rods will be forced into the ground by hydraulic means.

- The Hydropunch® tool is a double cylinder, designed to be sealed until the desired sampling depth is reached. Upon reaching the desired sampling depth, the outer cylinder is pulled back, exposing a perforated, stainless steel sampling barrel covered with filter material.

- The water sample enters the barrel and the sample is retrieved by pulling the probe rods from the hole with the hydraulic derrick and hammer assembly. Groundwater is the only media that is sampled by Hydropunch® equipment.

- The head of the rod may be equipped with a sensing device for characterization of the soil properties or the contaminant content.

- The sample volume collected with this technique is approximately 500-1,000 ml. Larger sample volumes can be collected by inserting tubing attached to a peristaltic pump into the rods to obtain water samples.

If desired, a small diameter monitoring well may be installed at this point. Refer to SOP No. 019 (Monitoring Well Installation).

If a well will not be installed, the rods will be removed as the borehole is simultaneously filled with a bentonite/grout mixture. A polyvinyl chloride (PVC) tube fed into the rod casing will allow the addition of grout.

3.3 SUBSURFACE SOIL – HYDRAULIC PUSHING AND SAMPLING

The objective of the selected DPT sampling technique is to allow grab samples to be taken at a selected site for characterization of the stratigraphy and for analysis of potential contaminants. The analytical results from sampling can also be used to determine the placement of monitoring wells.

A site geologist will be present during all DPT sampling and soil characterization. All procedures and soil characteristics will be fully documented in the Field Logbook (refer to SOP No. 003 [Field Logbook]).

The site geologist will have on hand, at a minimum, a copy of the approved Health and Safety Plan, this SOP, the Field Investigation Plan, a hand lens (10X), a standard color chart, and a grain-size chart.

Only solid vegetable shortening (e.g., Crisco®) without flavoring or additives may be used on downhole Geoprobe® equipment.

Surface runoff or other fluids will not be allowed to enter any DPT location or well during or after DPT activities.

The subcontractor will use the equipment specific guidelines for installation of the Geoprobe® DPT equipment. Probe rods will be forced into the ground by hydraulic means. Additional rods will be added in 3- to 4-ft increments until the leading edge of the sampler reaches the top of the desired sampling interval.

Once the desired sampling depth has been reached, insert extension rods down the inside diameter of the probe rods until it reaches the top of the sampler assembly. Attach the extension rod handle to the top extension rod. Turn the handle clockwise until the stop-pin detaches from the drive head. Remove the extension rods and the stop-pin. Attach a drive cap to the probe and drive the sampler approximately 2 ft using hydraulic derrick.

The DPT sampler can be retrieved by pulling the probe rods from the hole with the hydraulic derrick and hammer assembly.

The liner will be capped with Teflon® tape and vinyl end caps. The liners can be split open to remove samples for composition analysis or for transfer to other containers for shipment to the laboratory for analysis.

The head of the rod may be equipped with a sensing device for characterization of the soil properties or the contaminant content.

3.4 DECONTAMINATION

All Geoprobe® and Hydropunch® DPT equipment must be thoroughly cleaned before and after each use to allow retrieval of representative groundwater samples. Geoprobe® soil sample liners are disposed of after each use. Scrub all metal parts with a stiff, long bristle brush and a non-phosphate soap solution. Steam cleaning may be substituted where available. Rinse with distilled water and allow to air-dry before assembly.

After decontamination, a new clean liner will be installed and all parts will be inspected for wear or damage.

Refer to SOP No. 005 (Decontamination).

3.5 ABANDONMENT

Pure bentonite or a bentonite/grout mixture (20:1) will be used to fill the resulting borehole if the water table is penetrated. Boreholes that do not penetrate the water table will be backfilled with cuttings from the hole and topped with a bentonite seal. Clean sand will be used to fill any remaining volume in the borehole.

Abandonment of Geoprobe® and Hydropunch® generated DPT boreholes will meet the standards established under SOP No. 028 (Well and Boring Abandonment).

4. CONE PENETROMETER TESTING

4.1 MATERIALS

A CPT rig typically consists of an enclosed 20- to 40-ton truck equipped with vertical hydraulic rams that are used to force a sensor probe into the ground. The weight of the CPT rig is dependent upon the thrust required at the site. The majority of CPT rigs are mounted in heavy-duty trucks that are ballasted to a total dead weight of approximately 15 tons. Screw anchors are utilized to develop the extra reaction to reach the maximum thrust of 20 tons. The rig is separated into two separate workspaces: data acquisition and hydraulic push areas.

Water sources for CPT activities and decontamination must be approved by the Project Manager prior to arrival of the CPT equipment. Information required for the water source includes: water source, manufacturer/owner, address and telephone number, type of treatment and filtration prior to tap, time of access, cost per gallon (if applicable), dates and results associated with all available chemical analysis over the past 2 years, and the name and address of the analytical laboratory (if applicable).

Pure sodium bentonite with no additives will be the only additive allowed, and its use must be approved by the Project Manager prior to the arrival of the DPT equipment. The information required for evaluation includes: brand name, manufacturer, manufacturer's address and telephone number, product number, product description, and intended use for the product.

Portland Type II cement will be used for grout (refer to SOP No. 019).

4.2 SUBSURFACE CHARACTERIZATION

The objective of this technology is to collect stratigraphic information using CPT equipment to determine subsurface stratigraphy and geotechnical properties at a particular site. CPT activities will be in accordance with American Society for Testing and Materials D 3441-86 and American Society for Testing and Materials D 5778-95. The stratigraphic information gathered can be used to facilitate the selection of DPT sampling screen intervals. At the same time, it is possible to install a 0.25-in. diameter pre-packed PVC monitoring well.

CPT rods are used to hydraulically push the CPT probe into the subsurface. Probes cannot be pushed into hard rock, and significant gravel or cobble content in the formation may impede or preclude penetration of the probe. The depth of penetration achievable depends on the type of formation, type of sampling probe, and size of the hydraulic equipment used.

The CPT probe includes the following components:

- A conical tip to measure vertical resistance beneath the tip.
- A friction sleeve to measure frictional resistance on the side of the probe, as a function of depth.

- Two internal strain gauge-type load cells, which independently measure the vertical resistance and side friction.
- A cone pressure gauge to measure the water pressure as the probe is pushed into the ground.
- Inclinometer to determine potential drifting of the probe (optional).
- Seismic transducers to perform downhole seismic surveys (optional). Therefore, stratigraphic data collected with the CPT include: tip resistance, local friction, friction ratio, pore pressure, and resistivity.

Data will be transferred from the probe to the data acquisition system or logger through an electrical cable. The hole will be advanced continuously at a rate of 0.6-1.0 in. per second. The data will be logged at every 0.4-0.8 in. of penetration. Monitor the probe's stratigraphic position will be monitored as it advances downward. Perform pore water pressure dissipation tests in representative hydrostratigraphic intervals. Record dissipated pore water pressures to represent hydraulic head values.

Once the confining unit underlying the surficial aquifer or the required depth has been reached, the CPT is pulled from the ground. Target interval samples can be collected during CPT hole advancement using direct push sampling techniques, i.e., Geoprobe® or Hydropunch® (Section 3).

4.3 DECONTAMINATION

All CPT equipment must be thoroughly cleaned before arrival at the work site, between test holes, and prior to being moved out of a work area. Scrub all metal parts with a stiff, long bristle brush and a non-phosphate soap solution. Steam cleaning may be substituted where available. Rinse with distilled water and allow to air-dry before assembly.

Refer to SOP No. 005 (Decontamination).

4 .4 ABANDONMENT

If the push hole was developed for the stratigraphic test only, once the testing is completed, grout the hole from bottom to top. If the hole has not collapsed after removing the CPT, PVC piping will be used to grout the hole. If the hole has collapsed after removing the CPT, then hollow CPT rods and a sacrificial tip will be used to grout the hole. The PVC pipe or CPT rods will be pushed to the bottom of the hole. Grout will then be pumped to the bottom of the hole as the PVC pipe or CPT rods are withdrawn.

Refer to SOP No. 028 (Well and Boring Abandonment).

5. SITE CHARACTERIZATION AND ANALYSIS PENETROMETER SYSTEM

5.1 MATERIALS

SCAPS cone penetrometer and laser induced fluorescence (LIF) technology requires the use of a specialized 20-ton truck. The truck has two separate enclosed compartments. Each compartment is temperature controlled and monitored for air quality. The two rooms are the data acquisition and processing room, and the hydraulic ram/rod handling room. Approximately 20 ft of overhead clearance is required to fully extend the hydraulic ram and allow for leveling jack movement.

All materials required to complete SCAPS analysis are provided by the subcontractor to include cone penetrometer equipment. All hydraulic equipment, SCAPS rods, nitrogen lasers, etc. are included within the vehicle. A decontamination water source and a source of water for mixing the grout are required.

Water sources for equipment decontamination must be approved by the Project Manager prior to arrival of the SCAPS equipment. Information required for the water source includes: water source, manufacturer/owner, address and telephone number, type of treatment and filtration prior to tap, time of access, cost per gallon (if applicable), dates and results associated with all available chemical analysis over the past 2 years, and the name and address of the analytical laboratory (if applicable).

Pure sodium bentonite with no additives will be the only additive allowed, and its use must be approved by the Project Manager prior to the arrival of the SCAPS equipment. The information required for evaluation includes: brand name, manufacturer, manufacturer's address and telephone number, product number, product description, and intended use for the product.

Portland Type II cement will be used for grout (refer to SOP No. 019).

5.2 HYDRAULIC PUSHING AND SAMPLING

The objective of the SCAPS technique is to allow grab samples and stratigraphic information to be collected at a selected site to facilitate subsurface characterization and for analysis of potential contaminants. The analytical results obtained can also be used to determine the placement of monitoring wells. At the same time, it is possible to install a small diameter well for sampling purposes. Refer to SOP No. 019 (Monitoring Well Installation). If a well will not be installed, the borehole can be grouted as the equipment is removed.

A site geologist will be present during all installation and sampling procedures and will fully document all procedures and soil characteristics in the Field Logbook (refer to SOP No. 003 [Field Logbook]).

The site geologist will have on hand, at a minimum, a copy of the approved Health and Safety Plan, this SOP, the Field Investigation Work Plan, a hand lens (10X), a standard color chart, and a grain-size chart.

Only solid vegetable shortening (e.g., Crisco®) without flavoring or additives may be used on downhole SCAPS equipment.

Surface runoff or other fluids will not be allowed to enter any DPT location or well during or after direct-push activities.

The subcontractor will use the equipment specific guidelines for installation of the SCAPS DPT equipment. Prior to SCAPS field activities, calibration soil samples will be collected and analyzed in order to determine the LIF sensor fluorescence threshold and detection limits for the site.

SCAPS LIF technology uses a pulsed nitrogen laser coupled with an optical detector to make fluorescence measurements via optical fibers. The LIF sensor is mounted on a cone penetrometer probe so that soil classification data and fluorescence data are collected simultaneously. The laser consumes nitrogen gas, which is supplied from cylinders stored on the accompanying trailer.

The SCAPS CPT sensors are used to gather stratigraphic information. See Section 4 for CPT operating procedures.

Target interval samples can be collected during SCAPS hole advancement using direct push sampling techniques such as Geoprobe® or Hydropunch® (Section 3).

5.3 DECONTAMINATION

Decontamination of SCAPS equipment is automated after initialization by a field team member. A pressurized hot water system is used to decontaminate the push rods as they are retracted from the ground. The SCAPS vehicle is equipped with a decontamination collar mounted to the bottom that cleans the rods. The decontamination water is removed by vacuum and transferred to a storage drum prior to disposal or treatment. A trailer attached to the back of the vehicle contains the water pump, heater for decontamination, and decontamination water containment drum.

Worker exposure is reduced by minimizing contact with contaminated media.

Refer to SOP No. 005 (Decontamination).

5.4 ABANDONMENT

SCAPS automatically grouts the penetrometer cavity as the rods are removed. The grout is pumped at high pressure through a 0.25-in. diameter tube in the center of the penetrometer rods. The tip is sacrificed at the bottom of the cavity to allow release of the grout.

A trailer attached to the back of the vehicle contains the 300-gal grout mixing bin and pump.

If the automatic grout feed does not work, the cavity will be manually filled with grout.

Abandonment of SCAPS generated borehole will meet the standards established under SOP No. 028 (Well and Boring Abandonment).

6. MAINTENANCE

Not applicable.

7. PRECAUTIONS

Refer to the site-specific Health and Safety Plan for discussion of hazards and preventive measures during intrusive activities.

8. REFERENCES

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